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VOLUME 14 NUMBER 9 / MAY 8, 1976

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N76-18039*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 63
Nov. 1975 105 p
(NASA-SP-7037(63)) Avail: NTIS HC $4.00 (special price) CSCL 01A

This bibliography lists 340 reports, articles, and other documents introduced into the NASA scientific and technical information system in October 1975. Author

N76-18040*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME RECENT APPLICATIONS OF THE SUCTION ANALOGY TO VORTEX-LIFT ESTIMATES
John E. Lamar Feb. 1976 37 p refs Paper originally appeared in Aerodynamic Analyses Requiring Advan. Computers, part 2, NASA SP-347, p 985-1011, 4-6 Mar. 1975
(NASA-TM-X-72785) Avail: NTIS HC $4.00 CSCL 01A

An extension of the suction analogy for the estimation of vortex lift along the side edge of wings is reviewed along with the concept of an augmented vortex lift to account for the effect of the leading-edge vortex passing downstream over an aft part of the model. Applications of these extensions have resulted in an improved estimating capability for a wide range of isolated sharp-edge planforms and also for multiple lifting surfaces. Hence, the suction analogy concept can now have wider applicability at both subsonic and supersonic speeds, especially in the preliminary design cycle. Author

N76-18041*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND-TUNNEL INVESTIGATION OF VARIOUS SEGMENTS OF FLIGHT SPOILERS AS TRAILING-VORTEX-ALLEVIATION DEVICES ON A TRANSPORT AIRCRAFT MODEL
Delwin R. Croom Washington Mar. 1976 25 p refs
(NASA-TN-D-8162; L-10654) Avail: NTIS HC $3.50 CSCL 01A

An investigation was made in the Langley V/STOL tunnel to determine, by the trailing wing sensor technique, the effectiveness of various segments of the existing flight spoilers on a transport aircraft model when they were deflected as trailing-vortex-alleviation devices. The four combinations of flight-spoiler segments investigated were effective in reducing the induced rolling moment on the trailing wing model by as much as 40 to 50 percent at distances behind the transport model of from about 7 to 27 transport wing spans, 27 spans being the downstream limit of distances used in this investigation. Results obtained at about 7 wing spans downstream for two of the spoiler configurations indicate that essentially all the reduction in induced rolling moment on the trailing wing model was realized at a spoiler deflection of about 30 deg. Author

N76-18042*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREQUENCY OF ENCOUNTER OF AIRCRAFT IN A RANDOM HORIZONTAL FIELD
John D. Bird and Kathryn A. Smith Washington Feb. 1976 22 p refs
(NASA-TN-D-8149; L-10622) Avail: NTIS HC $3.50 CSCL 01A

Calculations were made of the frequency of encounter as a function of azimuth of encounter of a passing aircraft with the aircraft in a random planar horizontal field. All the field aircraft moved at a constant speed but in random directions. These calculations included the total frequency of encounter with the aircraft of the field and the frequency of encounter with those aircraft of the field which were encountered in the fore quadrant, in the lateral quadrants, and in the rear quadrant; the calculations were made for various speed ratios of the field aircraft and the passing aircraft. Author

N76-18043*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
AIRCRAFT MOTION AND PASSENGER COMFORT DATA FROM SCHEDULED COMMERCIAL AIRLINE FLIGHTS
Marta G. Gruesbeck and Daniel F. Sullivan Washington NASA Mar. 1976 233 p refs
(Grant NGR-47-005-181)
(NASA-CR-2612; MR-403212) Avail: NTIS HC $8.00 CSCL 05E

Data concerning the ride quality of aircraft taken on board commercial airline flights was presented. Five types of data are included: (1) root mean square (RMS) values of linear acceleration, angular acceleration or angular velocities, along with passenger subjective evaluations, (2) power spectra for the motion in each of six degrees of freedom, (3) scattergrams showing the probability density of the rms accelerations in the vertical and transverse directions, (4) probability distributions of the motion, and (5) on board noise levels during takeoff, climb, cruise, and descent. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-18044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECTS ON PROPULSION-INDUCED AERODYNAMIC FORCES OF VECTORING A PARTIAL-SPAN RECTANGULAR JET AT MACH NUMBERS FROM 0.40 TO 1.20
Francis J. Capone Washington Dec. 1975 250 p refs
(NASA-TN-D-8039; L-10352) Avail: NTIS HC $8.00 CSCL 01A

An investigation was conducted in the Langley 16-foot

transonic tunnel to determine the induced lift characteristics of a vectored thrust concept in which a rectangular jet exhaust nozzle was located in the fuselage at the wing trailing edge. The effects of nozzle deflection angles of 0 deg to 45 deg were studied at Mach numbers from 0.4 to 1.2, at angles of attack up to 14 deg, and with thrust coefficients up to 0.35. Separate force balances were used to determine total aerodynamic and thrust forces as well as thrust forces which allowed a direct measurement of jet turning angle at forward speeds. Wing pressure loading and flow characteristics using oil flow techniques were also studied. Author

N76-18045# Carleton Univ., Ottawa (Ontario). Dept. of Mechanical and Aeronautical Engineering.
INVESTIGATION OF THE DEVELOPMENT OF THE TRAILING VORTEX SYSTEM BEHIND A SWEPT-BACK WING
Z. El-ramly Oct. 1975 198 p refs
(Grant NRC-A-7799)
(ME/A-75-3) Avail: NTIS HC $7.50

Measurements of the trailing vortex system behind a 35 deg sweptback wing were made in a low speed wind tunnel. Spanwise and chordwise loading on the main wing was obtained from pressure distributions, and the character of the boundary layer flow was explored using oil-dot flow visualization and limited hot wire measurements. Mean flow properties of the vortex field were measured, using a non-nulling 5-hole probe, at two stations 21/2 and 5 main wing spans downstream. Using a simple strain-gauged balance, the induced rolling moment on two trailing wings (of representative relative scale and aircraft geometry), which intercepted the main wing vortex system, was also measured. Maximum induced rolling moments as well as variation with lateral and vertical position was found. For individual titles, see N76-18046 through N76-18053.

N76-18046 Carleton Univ., Ottawa (Ontario).
BACKGROUND
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 1-18 (For availability see N76-18045 09-02)

A general review of the problem is presented. Topics discussed include the initial formation and roll up of the vortex system, steady motion and gradual decay of vortex system, vortex rapid decay and disintegration, vortex dissipation and control, and experimental measurements and subscale modeling of aircraft trailing vortices. Author

N76-18047 Carleton Univ., Ottawa (Ontario).
ON THE EXPERIMENTAL APPROACH TO THE PROBLEM
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 19-23 (For availability see N76-18045 09-02)

Systematic wind tunnel experiments were conducted to answer key questions before theoretical work was started. Experiments involving wing configurations, engine simulation, flow field measurements, rolling moment measurements, wing loading, and surface flow visualization are described. Wind tunnel modifications and details of the work program are included. M.J.S.

N76-18048 Carleton Univ., Ottawa (Ontario).
EXPERIMENTAL SET-UP
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 24-41 (For availability see N76-18045 09-02)

A detailed description of the experimental set-up of the low speed wind tunnel is presented. The set-up includes a centerline locating device, the main wing and suction system, engine simulation, intercepting trailing wings and rolling moment balance, and the traversing mechanism. M.J.S.

N76-18049 Carleton Univ., Ottawa (Ontario).
WING LOADING AND SURFACE FLOW VISUALIZATION
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 42-70 (For availability see N76-18045 09-02)

The first set of measurements made were those of the main wing loading, basically to check the spanwise loading and to choose the appropriate angles of attack for the rest of the measurements. The main wing has 42 pressure plotting tubes let in to the surface in spanwise grooves, and pressure distributions can be taken at 14 spanwise stations using the multitube manometer (50 tubes). The most inboard measuring station is 11/2 in. from the root or about 0.16 root chord; the most outboard station is only 1/4 in. from the square cut tip (or about 0.08 tip chords) to monitor the steep gradient there. The stations are equally spaced except for station 7 which was too close to one of the engine outlet stations and so was displaced 1/2 in. to avoid measuring very local pylon effects. Measurements at any station can be made by covering the other 13 station pressure holes; 1 in. strips of Monokote tape 0.002 in. thick were used for that purpose and in addition are very suitable for surface flow visualization. The static holes are 0.030 in. diameter. Before any measurements were made the pressure holes for the 14 stations were covered and the system was carefully checked for leakage. During the measurements the uncovered station was always covered and the system checked for leaks before a new station was uncovered. Author

N76-18050 Carleton Univ., Ottawa (Ontario).
INDUCED ROLLING MOMENT MEASUREMENTS
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 71-83 (For availability see N76-18045 09-02)

The induced rolling moment measurement is a simple single overall measurement which gives a logical and easy means of comparing vortices and assessment of decay in relation to hazard to following aircraft. Detailed induced rolling moment measurements were made at incidence angles of 5 deg, 6.25 deg and 11 deg; maximum induced roll moments were measured at a few more incidences up to a maximum of alpha = 12.8 deg. With measurements taken at the two downstream stations 21/2 and 5b it was hoped that some kind of a gross decay parameter will be determined. The effect of the tip (1/2 body of revolution) on the induced rolling moment as well as the variation with free stream dynamic pressure were also investigated. Author

N76-18051 Carleton Univ., Ottawa (Ontario).
FLOW FIELD MEASUREMENTS
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 84-98 (For availability see N76-18045 09-02)

The flow field measurements include the 5-hole nonnulling probe measurements, which include the three components of local mean velocity and the local total pressure. Flow field measurements were taken at the two downstream measuring stations 21/2 and 5 main wing spans with the probe tip located axially at the position of the straight trailing wing 1/4 chord line, and at main wing angles of attack alpha = 5 deg and 11 deg. To remove free stream irregularities, traversing mechanism upstream effects and any probe misalignment with the free stream, main wing out measurements were also taken at the two stations. Because the flow field measurements (total pressure loss coefficient, normalized tangential velocity, and normalized axial velocity) revealed some interesting characteristics of the flow, the results are presented in their raw as measured form. Author

N76-18052 Carleton Univ., Ottawa (Ontario).
DISCUSSION OF THE CLEAN WING CONFIGURATION RESULTS
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 99-120 (For availability see N76-18045 09-02)

Results of the clean wing configuration are discussed in detail. Specific topics discussed include main wing loading and the circulation distribution, roll up of the trailing vortex, the effect of tunnel wall interference on roll up, location of vortex center, vortex induced velocity field, vortex core, and induced rolling moment on trailing wings. M.J.S.

N76-18053 Carleton Univ., Ottawa (Ontario).
EFFECT OF SIMULATED JET ENGINES ON THE VORTEX FLOW FIELD
In its Invest. of the Develop. of the Trailing Vortex System Behind a Swept-Back Wing Oct. 1975 p 121-145 (For availability see N76-18045 09-02)

The engines were designed to simulate a Boeing 747 with JT9D engines in the cruise condition (with a mixed jet exit velocity to free stream velocity ratio of 1.5). To avoid comparing measurements taken at different speeds and Reynolds number, measurements and comparisons were made as follows: (1) With the two engines mounted but with no air injection, tests were made at maximum tunnel speed and compared to the clean wing configuration results. Effects of engine pylons and nacelles on main wing loading, flow field, and induced rolling moment on the small trailing wing are thus detected. (2) Tests for condition (1) were repeated at a free stream velocity of about 115 f.p.s (the maximum possible speed for jet exhaust simulation). A reference condition is available for studying the effects of the simulated jet exhaust; it is also possible to study possible speed effects by comparing results of (1) and (2). (3) Measurements with simulated jet exhaust (cold air simulation only), at a free stream velocity of about 115 f.p.s, are compared to the no-injection case. For the measurements reported here the inboard engine was at the spanwise position $2y/b = 0.4$ and the outboard engine was at the $2y/b = 0.66$ position. Author

N76-18054*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VISCOUS/POTENTIAL FLOW ABOUT MULTI-ELEMENT TWO-DIMENSIONAL AND INFINITE-SPAN SWEPT WINGS: THEORY AND EXPERIMENT

L. E. Olson (USAAMRDL) and F. A. Dvorak (Analytical Methods) Dec. 1975 11 p refs

(NASA-TM-X-62513; A-6389) Avail: NTIS HC $3.50 CSCL 01A

The viscous subsonic flow past two-dimensional and infinite-span swept multi-component airfoils is studied theoretically and experimentally. The computerized analysis is based on iteratively coupled boundary layer and potential flow analysis. The method, which is restricted to flows with only slight separation, gives surface pressure distribution, chordwise and spanwise boundary layer characteristics, lift, drag, and pitching moment for airfoil configurations with up to four elements. Merging confluent boundary layers are treated. Theoretical predictions are compared with an exact theoretical potential flow solution and with experimental measures made in the Ames 40- by 80-Foot Wind Tunnel for both two-dimensional and infinite-span swept wing configurations. Section lift characteristics are accurately predicted for zero and moderate sweep angles where flow separation effects are negligible. Author

N76-18055*# Goodyear Aerospace Corp., Akron, Ohio.

SCALE DROGUE PARACHUTE MODEL Final Report, 30 Apr. - 28 Jun. 1974

Jul. 1974 26 p

(Contract NAS8-30848)

(NASA-CR-120719; GER-16130) Avail: NTIS HC $4.00 CSCL 01A

Drogue parachute models, pilot parachute models, and their deployment bags were fabricated incorporating recommended design changes. These changes are described in detail. Author

N76-18056*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLOW VISUALIZATION OF VORTICES LOCKED BY SPANWISE BLOWING OVER WINGS FEATURING A UNIQUE LEADING AND TRAILING-EDGE FLAP SYSTEM

Gary E. Erickson and James F. Campbell (George Washington Univ.) Dec. 1975 103 p refs

(NASA-TM-X-72788) Avail: NTIS HC $5.50 CSCL 01A

Flow visualization studies were conducted to qualitatively determine the effects of active generation and augmentation of vortex flow over wings by blowing a discrete jet in a spanwise direction in the channel formed by extension of upper surface leading- and trailing-edge flaps. Spanwise blowing from a reflection plane over a rectangular wing was found to generate and lock a dual corotating vortex system within the channel and, at sufficient blowing rates, cause the separated flow off the upper end of the leading-edge flap to reattach to the trailing-edge flap. Test parameters included wing angle of attack, jet momentum coefficient, leading- and trailing-edge flap deflection angle, and jet location above the wing surface. Effects due to removal of the leading- and trailing-edge flap were also investigated. Author

N76-18057*# Iowa State Univ. of Science and Technology, Ames.

CORRELATION OF TURBULENT TRAILING VORTEX DECAY DATA

James D. Iversen [1974] 23 p refs

(Contract NCAR-340-401)

(NASA-CR-146282) Avail: NTIS HC $3.50 CSCL 20D

A correlation function, derived on the basis of self similar variable eddy viscosity decay, is introduced and utilized to correlate aircraft trailing vortex velocity data from ground and flight experiments. The correlation function collapses maximum tangential velocity data from scale model and flight tests to a single curve. The resulting curve clearly shows both the inviscid plateau and the downstream decay regions. A comparison between experimental data and numerical solution shows closer agreement with the variable eddy viscosity solution than the constant viscosity analytical solution. Author

N76-18058*# United Aircraft Corp., Stratford, Conn.

DERIVATION OF EQUATIONS OF MOTION FOR MULTI-BLADE ROTORS EMPLOYING COUPLED MODES AND INCLUDING HIGH TWIST CAPABILITY

R. Sopher 27 Feb. 1975 297 p refs

(Contract NAS2-6463)

(NASA-CR-137810; SER-50912) Avail: NTIS HC $9.25 CSCL 01A

The equations of motion are derived for a multiblade rotor. A high twist capability and coupled flatwise-edgewise assumed normal modes are employed instead of uncoupled flatwise - edgewise assumed normal models. The torsion mode is uncoupled. Support system models, consisting of complete helicopters in free flight, or grounded flexible supports, arbitrary rotor-induced inflow, and arbitrary vertical gust models are also used. Author

N76-18059# Advisory Group for Aerospace Research and Development, Paris (France).

COMMENTS ON TRANSONIC AND WING-STORE UNSTEADY AERODYNAMICS

H. Tijdeman (NLR) and R. Destuynder (ONERA) Jan. 1976 42 p refs In ENGLISH and partly in FRENCH

(AGARD-R-636) Avail: NTIS HC $4.00

Papers given in September 1975 before the Structures and Materials Panel Sub-Committee on Aeroelasticity and Unsteady Aerodynamics, are presented. The first presents an in-depth review of the present state-of-the-art in transonic unsteady aerodynamics. Some of the most advanced methods are discussed and evaluated. An illustration of typical effects occurring in high subsonic and transonic flow around oscillating airfoils and wings is presented. Some useful conclusions are drawn. The second paper contains a description of measurements made on a variety of wing-store combinators, and compares these measurements with theoretical values derived from two different methods, one developed by ONERA and the other by NLR. A conclusion regarding the main factor affecting variation in lift coefficients of wings-with-stores is drawn. For individual titles, see N76-18060 through N76-18063.

N76-18060 Advisory Group for Aerospace Research and Development, Paris (France).

CHARACTERISTICS OF 2-D UNSTEADY TRANSONIC FLOW

In its Comments on Transonic and Wing-Store Unsteady Aerodyn. Jan. 1976 p 2-5 (For availability see N76-18059 09-02)

Characteristics of unsteady high subsonic and transonic flow are illustrated by use of experimental results from a 2-D airfoil with a sinusoidally steady and unsteady airloads. The results of the wind tunnel tests on an airfoil with oscillating flap, and unsteady flow field are discussed along with periodical shock wave motion. The calculation methods for 2-D unsteady flow are reviewed. F.O.S.

N76-18061 Advisory Group for Aerospace Research and Development, Paris (France).

EVALUATION OF CALCULATION METHODS FOR 2-D UNSTEADY TRANSONIC FLOW

In its Comments on Transonic and Wing-Store Unsteady Aerodyn. Jan. 1976 p 5-7 (For availability see N76-18059 09-02)

The methods for solving the problem of two-dimensional

unsteady transonic flow are discussed for oscillating airfoils. The thickness effects and influence of the boundary layer are considered along with the unsteady shock wave motion. F.O.S.

N76-18062 Advisory Group for Aerospace Research and Development, Paris (France).
UNSTEADY TRANSONIC FLOW
In its Comments on Transonic and Wing-Store Unsteady Aerodyn. Jan. 1976 p 7-8 (For availability see N76-18059 09-02)

The transonic flow around oscillating finite three-dimensional wings is discussed. The experimental evidence that supports the development of prediction methods for three-dimensional flow is reviewed, and the calculation methods for 3-D unsteady flow are analyzed. F.O.S.

N76-18063 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY PRESSURE MEASUREMENTS IN WING-WITH-STORE CONFIGURATIONS
Roger Destuynder *In* AGARD Comments on Transonic and Wing-Store Unsteady Aerodyn. Jan. 1976 p 30-37 refs In FRENCH; ENGLISH summary (For availability see N76-18059 09-02)

Measurements are made at various Mach numbers on a semi-span model oscillating in pitch. Several kinds of stores, differing in size and position, were mounted. In each case, the characteristic values due to the store itself, those due to the interaction between wing and store, and lastly the values relative to the clean wing were measured. Calculations were performed in order to compare theory and experiment. Two methods were applied: the first one, developed by ONERA, is a semi-empirical method making use of Mach number fields; the other one, used by the NLR Amsterdam, is more complete as it determines directly the interaction between wing and store, introducing source and doublet distributions on the store, the pylon and the wing. In all cases, it appears that the main term is the interaction created by the store on the wing, which can entail a variation of up to 15% of the lift coefficient. Author

N76-18064# Advisory Group for Aerospace Research and Development, Paris (France).
COMPARISON BETWEEN THE CALCULATED AND MEASURED TRANSFER FUNCTIONS FOR THE CONCORDE AIRCRAFT [COMPARAISON DES FONCTIONS DE TRANSFERT CALCULEES ET MESUREES SUR LAVION CONCORDE]
J. Roustan Jan. 1976 21 p In FRENCH
(AGARD-R-637) Avail: NTIS HC $3.50

A comprehensive and detailed analysis is presented of the comparison between calculations and actual in-flight measurements of the transfer functions of the Concorde Supersonic Transport aircraft through atmospheric turbulence at differing altitudes and speeds. Numerous graphs and charts are included. Results indicate that the aircraft presently defies as effective analysis of its response to turbulence. Recommendations for future research are discussed. Author

N76-18065# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE VORTEX WAKE OF A CLOSELY SPACE ROW OF CYLINDERS
D. Weihs Sep. 1975 32 p refs
(TAE-261) Avail: NTIS HC $4.00

The wake of a row of cylindrical bodies is studied analytically for cases in which periodic vortex shedding is observed. Using an inviscid flow model, a closed form analytical solution, in terms of elliptic Theta functions, of the complex potential is obtained. It is found that when the average flow downstream of the obstacles is in the freestream direction the vorticity is shed from neighboring bodies with 180 deg phase difference, while in-phase shedding occurs for deflected streams. Changes in the average drag force on each cylinder due to the presence of other members of the row is calculated. For certain blockage ratios a decrease in the drag is predicted, while for large concentrations of bodies an increase by a factor of over 3 is obtained. Comparisons with partial experimental data collected from various sources show that the predictions of the present theory are found in practice, with good numerical agreement. Author

N76-18066*# Computer Sciences Corp., Wallops Island, Va. Field Services Div.
SENS-5D TRAJECTORY AND WIND-SENSITIVITY CALCULATIONS FOR UNGUIDED ROCKETS
Raghubansh P. Singh, Louis C. P. Huang, and Ronald A. Cook Dec. 1975 155 p refs
(Contract NAS6-2369)
(NASA-CR-141402) Avail: NTIS HC $6.75 CSCL 01A

A computational procedure is described which numerically integrates the equations of motion of an unguided rocket. Three translational and two angular (roll discarded) degrees of freedom are integrated through the final burnout; and then, through impact, only three translational motions are considered. Input to the routine is: initial time, altitude and velocity, vehicle characteristics, and other defined options. Input format has a wide range of flexibility for special calculations. Output is geared mainly to the wind-weighting procedure, and includes summary of trajectory at burnout, apogee and impact, summary of spent-stage trajectories, detailed position and vehicle data, unit-wind effects for head, tail and cross winds, coriolis deflections, range derivative, and the sensitivity curves (the so called F(Z) and DF(Z) curves). The numerical integration procedure is a fourth-order, modified Adams-Bashforth Predictor-Corrector method. This method is supplemented by a fourth-order Runge-Kutta method to start the integration at t = 0 and whenever error criteria demand a change in step size. Author

N76-18067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND TUNNEL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF FIVE FOREBODY MODELS AT HIGH ANGLES OF ATTACK AT MACH NUMBERS FROM 0.25 TO 2
Earl R. Keener and Jamshid Taleghani Dec. 1975 105 p refs
(NASA-TM-X-73076; A-6280) Avail: NTIS HC $5.50 CSCL 01A

Five forebody models of various shapes were tested in the Ames 6- by 6-Foot Wind Tunnel to determine the aerodynamic characteristics at Mach numbers from 0.25 to 2 at a Reynolds number of 800000. At a Mach number of 0.6 the Reynolds number was varied from 0.4 to 1.8 mil. Angle of attack was varied from -2 deg to 88 deg at zero sideslip. The purpose of the investigation was to determine the effect of Mach number of the side force that develops at low speeds and zero sideslip for all of these forebody models when the nose is pointed. Test results show that with increasing Mach number the maximum side forces decrease to zero between Mach numbers of 0.8 and 1.5, depending on the nose angle; the smaller the nose angle of the higher the Mach number at which the side force exists. At a Mach number of 0.6 there is some variation of side force with Reynolds number, the variation being the largest for the more slender tangent ogive. Author

N76-18068# Aircraft Research Association, Ltd., Bedford (England).
WIND TUNNEL MEASUREMENTS OF THE TRANSONIC DRAG OF EXCRESCENCES IMMERSED IN A TURBULENT BOUNDARY LAYER
K. C. Pallister Dec. 1974 59 p refs
(Rept-37) Avail: NTIS HC $4.50

The drag of step, ridge, circular hole, and circular cylinder excrescences was measured in a transonic wind tunnel in the Mach number range 0.6 to 1.4. These excrescences were mounted on the tunnel floor and with the exception of the cylinders were totally immersed in a thick turbulent boundary layer. For ridges and steps the increase in drag coefficient with Mach number is generally small up to M 0.90 but beyond M 0.90 there is generally a rapid increase to a peak C sub D value at a low supersonic Mach number. Peak values up to 25 times the subsonic level were recorded. The drag coefficient for shallow holes remains constant or decreases slightly through the transonic range. Some results are presented to illustrate the effect of an excrescence on the downstream flow. Author

N76-18069*# Boeing Vertol Co., Philadelphia, Pa.
INVESTIGATION OF ROTOR BLADE ELEMENT AIRLOADS FOR A TEETERING ROTOR IN THE BLADE STALL REGIME (SECOND WIND TUNNEL TEST)

L. U. Dadone and T. Fukushima Oct. 1975 104 p refs Sponsored in part by Army Air Mobility R and D Lab., Moffett Field Calif. (Contract NAS2-7229)
(NASA-CR-137534; D210-10792-3) Avail: NTIS HC $5.50 CSCL 01A

A test was conducted in the NASA-Ames 7 x 10 ft low speed wind tunnel on a seven-foot diameter model of a teetering rotor. The objectives of the test were: (1) acquire pressure data for correlation with laser and flow visualization measurements; (2) explore rotor propulsive force limits by varying the advance ratio at constant lift and propulsive force coefficients; (3) obtain additional data to define the differences between teetering and articulated rotors; and (4) verify the acceleration sensitivity of experimental transducers. Results are presented. Author

N76-18070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF NOZZLE EXIT LOCATION AND SHAPE PROPULSION-INDUCED AERODYNAMIC CHARACTERISTICS DUE TO VECTORING TWIN NOZZLES AT MACH NUMBERS FROM 0.40 TO 1.2
Francis J. Capone Washington Jan. 1976 205 p refs
(NASA-TM-X-3313; L-10493) Avail: NTIS HC $7.75 CSCL 01A

An investigation was conducted in the Langley 16-foot transonic tunnel to determine the induced lift characteristics of a vectored-thrust concept in which jet-exhaust nozzles were located in the fuselage at or near the wing trailing edge. The effects of moving twin rectangular nozzles rearward from the wing trailing edge and of round nozzles at the trailing edge only were studied at Mach numbers from 0.4 to 1.2, angles of attack up to 14 deg, and thrust coefficients up to 0.35. Nozzle deflection angle varied from 0 deg to 45 deg. Separate force balances were used to determine both total aerodynamic and thrust forces and thrust forces alone which allowed for a direct measurement of jet turning angle at forward speeds. The Reynolds number per meter varied from 8.20 x 1 million to 13.12 x 1 million. Author

N76-18071*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CASING TREATMENT ON PERFORMANCE OF AN INLET STAGE FOR A TRANSONIC MULTISTAGE COMPRESSOR
Donald C. Urasek, George W. Lewis, Jr., and Royce D. Moore Washington Feb. 1976 125 p refs
(NASA-TM-X-3347; E-8183) Avail: NTIS HC $5.50 CSCL 01A

An inlet stage of a transonic compressor was tested with three rotor tip casing treatment configurations: blade angle slots, circumferential grooves, and axial skewed slots. Significant increases in both rotor and stage total pressure ratio, total temperature ratio, efficiency, flow range, and very large improvements in stall margin were obtained with all three casing treatment configurations. The greatest improvement in performance was achieved with axial skewed slots. Author

N76-18072*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECT OF WING BEND ON THE EXPERIMENTAL FORCE AND MOMENT CHARACTERISTICS OF AN OBLIQUE WING
Edward J. Hopkins and Edgar R. Nelson (ARO, Inc., Moffett Field, Calif.) Washington Mar. 1976 164 p refs
(NASA-TM-X-3343; A-6068) Avail: NTIS HC $6.75 CSCL 01A

Static longitudinal and lateral/directional force and moment characteristics are presented for an elliptical oblique wing mounted on top of a Sears-Haack body of revolution. The wing had an aspect ratio of 6 (based on the unswept span) and was tested at various sweep angles relative to the body axis ranging from 0 to 60 deg. In an attempt to create more symmetrical spanwise wing stalling characteristics, both wing panels were bent upward to produce washout on the trailing wing panel and washing on the leading wing panel. Small fluorescent tufts were attached to the wing surface to indicate the stall progression on the wing. The tests were conducted throughout a Mach number range from 0.6 to 1.4 at a constant unit Reynolds number of 8.2 x 10 per meter. The test results indicate that upward bending of the wing panels had only a small effect on the linearity of the moment curves and would require an impractical wing-pivot location at low lift to eliminate the rolling moment resulting from this bending. Author

N76-18073# Atlantic Research Corp., Alexandria, Va.
DRAG COEFFICIENTS OF SPHERES IN CONTINUUM AND RAREFIED FLOWS
Charles B. Henderson 23 Feb. 1976 26 p refs Backup document for AIAA synoptic scheduled for publication in AIAA Journal in Jun. 1976
Avail: NTIS HC $4.00

Experimental results, theories, and empirical correlations of drag coefficients for spheres are reviewed. Emphasis is placed on the continuum and rarefied flow regimes ordinarily encountered in gas-particle nozzle flow with Mach numbers ranging from 10 to the minus 7 to 6. A new set of correlating equations is proposed which offer a significant improvement in accuracy over previous correlations. The maximum deviation from a set of 219 experimental and theoretical drag coefficients is 16 percent. In the limit, the correlating equations simplify to the theoretical equations applicable to the Stokes-Oseen, low-velocity slip, and molecular flow regimes. Author

N76-18074*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EVALUATION OF THE METHOD FOR DETERMINING THE WHITHAM F-FUNCTION USING DISTRIBUTIONS OF DOWNWASH AND SIDEWASH ANGLES
Joel P. Mendoza and Raymond M. Hicks Washington Mar. 1976 23 p refs
(NASA-TM-X-3363; A-6228) Avail: NTIS HC $3.50 CSCL 01A

The method of computing the Whitham F function using distributions of downwash and sidewash angles was evaluated with two different models. F functions which were calculated for a half angle cone cylinder at M infinites = 2.01, using theoretically and experimentally derived flow angles, show that the method is sensitive to small inaccuracies in the measured flow angles. An oblique wing transport model was tested at 0 deg angle of attack at M infinitely = 2.01. In this test, two different probes were used at two different distances from the model. The pressure signature derived from the F function was extrapolated and compared to the pressure signature measured at the distance of 0.87 body lengths with the static pressure probe. The agreement between the two pressure signatures was poor due to the many inaccuracies involved in using a probe designed to measure flow angularity. Author

N76-18075# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE VORTEX WAKE OF A CLOSELY SPACED ROW OF CYLINDERS
D. Weihs Sep. 1975 32 p refs
(TAE-261) Avail: NTIS HC $4.00

The wake of a row of cylindrical bodies is studied analytically for cases in which periodic vortex shedding is observed. Using an inviscid flow model, a closed form analytical solution, in terms of elliptic Theta functions, of the complex potential is obtained. It is found that when the average flow downstream of the obstacles is in the freestream direction the vorticity is shed from neighboring bodies with 180 deg phase difference, while in-phase shedding occurs for deflected streams. Changes in the average drag force on each cylinder due to the presence of other members of the row is calculated. For certain blockage ratios a decrease in the drag is predicted, while for large concentrations of bodies an increase by a factor of over 3 is obtained. Comparisons with partial experimental data collected from various sources show that the predictions of the theory are found in practice, with good numerical agreement. Author

N76-18076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERALL AND BLADE ELEMENT PERFORMANCE OF A 1.20 PRESSURE RATIO FAN STAGE WITH ROTOR BLADES RESET -7 DEG
George W. Lewis, Jr. and George Kovich Washington Mar.

1976 81 p refs
(NASA-TM-X-3342; E-8063) Avail: NTIS HC $5.00 CSCL 01A

A 51-cm-diam model of a fan stage for short haul aircraft was tested in a single stage compressor research facility. The rotor blades were set 7 deg toward the axial direction (opened) from the design setting angle. Surveys of the air flow conditions ahead of the rotor, between the rotor and stator, and behind the stator were made over the stable operating range of the stage. At the design speed and a weight flow of 30.9 kg/sec, the stage pressure ratio and efficiency were 1.205 and 0.85, respectively. The design speed rotor peak efficiency of 0.90 occurred at a flow rate of 32.5 kg/sec. Author

N76-18077*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OVERALL AND BLADE ELEMENT PERFORMANCE OF A 1.20-PRESSURE-RATIO FAN STAGE WITH ROTOR BLADES RESET -5 DEG
George W. Lewis, Jr., Walter M. Osborn, and Royce D. Moore Washington Mar. 1976 91 p refs
(NASA-TM-X-3338; E-8057) Avail: NTIS HC $5.00 CSCL 01A

A 51-cm-diam model of a fan stage for a short haul aircraft was tested in a single stage-compressor research facility. The rotor blades were set 5 deg toward the axial direction (opened) from design setting angle. Surveys of the air flow conditions ahead of the rotor, between the rotor and stator, and behind the stator were made over the stable operating range of the stage. At the design speed of 213.3 m/sec and a weight flow of 31.5 kg/sec, the stage pressure ratio and efficiency were 1.195 and 0.88, respectively. The design speed rotor peak efficiency of 0.91 occurred at the same flow rate. Author

N76-18078*# Scientific Translation Service, Santa Barbara, Calif.
NON-EQUILIBRIUM PHYSICO-CHEMICAL PROCESSES IN AERODYNAMICS
V. P. Agafonov, V. K. Vertushkin, A. A. Gladkov, and O. Yu. Polyanskiy Washington NASA Mar. 1976 491 p refs Transl. into ENGLISH of the book "Neravnovesnyye Fiziko-Khimicheskiye Protsessy v Aerodinamikie" Moscow, Mashinostroyeniye Press, 1972 p 1-344
(Contract NASw-2483)
(NASA-TT-F-787) Avail: NTIS HC $12.50 CSCL 01A

The physico-chemical processes in high temperature gas flows and their effect on gas dynamic parameters are considered. Information is given on the chemico-physical, thermodynamic, and kinematic properties of gases. The fundamental equations are formulated, and the general properties of nonequilibrium flows are described. Other topics discussed include: one-dimensional flows; the structure of a shock wave in a gas mixture; the properties of nonequilibrium flows in a stream filament; external gas dynamics of nonviscous nonequilibrium flows; and the flow around blunt and sharp bodies. Within the framework of the boundary layer theory, viscous nonequilibrium flows are discussed including the effect of chemical reactions on the surface, the flow in the neighborhood of a critical point of a blunt body, the flow around a flat plate and a cone. Author

N76-18079# Stanford Univ., Calif.
NONLINEAR EQUATIONS OF MOTION FOR TWISTED NONUNIFORM ROTATING BEAMS
Dewey H. Hodges and George Herrmann May 1975 59 p refs
(Grant AF-AFOSR-2669-74; AF Proj. 9782)
(AD-A015850; SUDAM-75-6; AFOSR-75-1276TR) Avail: NTIS CSCL 01/1

Nonlinear partial differential equations of motion suitable for describing bending in two directions and torsion of a rotating cantilevered beam are derived by use of Hamilton's principle. A nonlinear strain displacement relation is developed based on a newly constructed coordinate transformation and forms an important contribution to the final equations. In determining the order of various terms in the derivation, it is assumed that the squares of the bending (flap and lead-lag) slopes, of the torsion deformation, and of the chord/radius and thickness/radius ratios are small compared to unity, but otherwise all nonlinear terms are retained. Thus the more important nonlinear terms are identified. In addition to the product of bending curvatures (discussed by earlier authors) which generates a twist about the blade elastic axis, it is found that a product of bending curvature in one direction and twist generates a bending moment for the other direction of bending. In general all such terms are of equal physical importance and could substantially influence the stability and response of hingeless or cantilevered helicopter rotor blades, particularly when such blades are significantly deformed under normal operating loads. GRA

N76-18080# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A STABILITY ANALYSIS OF TANDEM PARACHUTE MID-AIR RECOVERY SYSTEMS Final Report
Michael W. Higgins and Ralph J. Speelman, III May 1975 218 p refs
(AF Proj. 4688)
(AD-A015746; AFFDL-TR-74-149) Avail: NTIS CSCL 01/3

The objective of this report is to present the derivation and application of an analytical technique to quantitatively predict and measure the performance/stability of a tandem parachute Mid-Air Recovery System (MARS). In this system, a main parachute is used to control the rate of descent of the payload and a smaller parachute, tethered to the apex of this main chute, serves as an engagement target for the recovery aircraft. Significant parameters relevant to the position and stability of the engagement parachute are identified and quantified. Those parameters relevant to system stability, as viewed by the pilot of the retrieval aircraft, are combined into a single numerically valued stability factor. Sensitivity of the stability factor to variation of its components is assessed. The stability quantification technique is applied to flight test data from two different systems. On one system, the performance of gliding and nongliding main canopy configurations is analyzed and compared. For the other system, an estimation is made of the potential change in performance obtainable through conversion from a non-gliding to a gliding main parachute. Potential refinements of the stability quantification technique to improve its sensitivity are presented. Author (GRA)

N76-18081# Texas A&M Univ., College Station.
AERODYNAMIC COEFFICIENTS FOR A STAGGERED CASCADE OF OSCILLATING AIRFOILS IN SUBSONIC FLOW Interim Report
W. P. Jones and Jimmie A. Moore May 1975 38 p refs
(Grant AF-AFOSR-2700-74; AF Proj. 6813; AF Proj. 9781)
(AD-A015912; TEES-3068-75-02; AFOSR-75-1216TR) Avail: NTIS CSCL 20/4

A method developed and described in an earlier paper is used to determine the aerodynamic coefficients for a cascade of staggered airfoils in compressible subsonic flow. In that report, the case of the unstaggered cascade was considered and in the present report the authors extend their earlier work to include a study of the effects of stagger angle on the aerodynamic coefficients. Particular attention is devoted to changes in the direct aerodynamic damping coefficients for plunging and pitching oscillations in high Mach number flow for particular values of the phase difference between the motions of adjacent staggered airfoils. GRA

N76-18082# Columbia Research Corp., Gaithersburg, Md.
DESIGN, DEVELOPMENT AND FABRICATION OF A FOA ENERGY SEPARATOR FOR USE IN AIRCRAFT ON-BOARD OXYGEN GENERATING SYSTEMS Final Report
22 Feb. 1975 39 p refs
(Contract N62269-73-C-0686)
(AD-A015621; CRC-122-8) Avail: NTIS CSCL 20/4

Contained herein is the development of a FOA Energy Separator (FES), a Cryptosteady device which separates an air flow into hot and cold fractions. The device is thermodynamically similar to the principle of a back-to-back expander-compressor, which in actuality does not exist. Therefore, the FES stands alone as a device to provide cooling without the need for heat exchange with the surroundings. This report describes its development specifically for application to the on-board generation of oxygen for future high performance Navy aircraft. GRA

N76-18083# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A SOLUTION FOR LAMINAR FLOW PAST A ROTATING CYLINDER IN CROSS FLOW Final Report
Kevin S. Fansler and James E. Danberg Aug. 1975 88 p refs
(DA Proj. 1T1-61102-A-33H)
(AD-A016113; BRL-1816) Avail: NTIS CSCL 20/4

Two-dimensional subcritical flow past a rotating cylinder has been theoretically treated to obtain agreement with the boundary-layer calculations. This study combined a source-wake bound-vortex flow model with a moving-wall boundary-layer calculation to force the final inviscid-flow model to be consistent with boundary-layer theory. Consistency was obtained by an iterative process whereby the separation points of the inviscid-flow model converged toward the separation points found by boundary-layer calculations. The boundary-layer is calculated using the integral-momentum and the integral-energy equations where the family of moving-wall similarity boundary-layer solutions provide relationships between some parameters of the equations. GRA

N76-18084# Science Applications, Inc., Ann Arbor, Mich.
LOW SPEED SEPARATION Final Report
Patrick J. Roache 15 Sep. 1975 21 p refs
(Contract N00014-75-C-0068)
(AD-A015712; SAI-75-510-AQ) Avail: NTIS CSCL 20/4

Two approaches are considered for the high Reynolds number separated flow computational problem: these are high-order finite difference methods and Fourier Transform methods. A technique called 'reduction to periodicity', which allows the use of the FFT on non-periodic problems is tested and verified. This technique is shown to be a worthwile contribution to computational fluid dynamics, and does address one aspect of the high Reynolds number problem, but it does not by itself allow the accurate solution of high Reynolds number separated flows. GRA

N76-18085# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
TEST TECHNIQUES FOR HIGH-LIFT, TWO-DIMENSIONAL AIRFOILS WITH BOUNDARY LAYER AND CIRCULATION CONTROL FOR APPLICATION TO ROTARY WING AIRCRAFT Final Report
R. J. Englar and R. M. Williams Jul. 1975 23 p refs
(NR Proj. 215-215)
(AD-A015623; Aero-1205; NSRDC-4645) Avail: NTIS CSCL 14/2

Extensive testing experience with very high lift mono-element blown airfoils to be employed by rotary wing aircraft has necessitated the development of unconventional two-dimensional test techniques. Both experimental and analytical results are presented which should assist future investigators in conducting similar tests accurately. The primary problem of high lift two-dimensional testing, wall boundary layer separation due to severe adverse pressure gradients on the model, is discussed as are the serious errors introduced by this phenomenon. A detailed discussion is presented concerning the additional considerations which must be given to blown airfoil testing. Such additional test problems as wall and blockage corrections, Reynolds number effects, leading edge separation, and flow visualization are addressed. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-18086# Systems Technology, Inc., Hawthorne, Calif.
ILS GLIDE SLOPE STANDARDS: PART 1: A REVIEW OF FLIGHT INSPECTION STANDARDS AFFECTING LANDING PERFORMANCE AND COMPARISON WITH LIMITS EVOLVED FROM SYSTEM ANALYSIS
L. G. Hofmann, W. E. Clement, D. Graham, G. L. Teper, B. L. Wiscons (Collins Radio Co., Cedar Rapids, Iowa), D. L. Hemel (Collins Radio Co., Cedar Rapids, Iowa), and R. H. McFarland Jun. 1975 306 p refs
(Contract DOT-FA74WA-3340)
(AD-A017087/8; TR-1043-1; FAA-RD-74-119-1-Pt-1) Avail: NTIS HC $9.75 CSCL 01/2

System analysis techniques are used to determine maximum levels for ILS glide slope beam structure characteristics which will result in acceptable approach and landing outcomes. Results are based upon a power spectral density signature for ILS glide slopes obtained from a nonstationary statistical analysis of flight inspection data. Maximum levels and standard deviation time historics for typical aircraft/control system response, indicated glide path deviation, actual glide path deviation, and actual glide path deviation rate, are used as the basis for recommending revisions to the ILS glide slope flight inspection data processing procedures, and for recommending relaxed flight inspection standards. The maximum extent to which current glide slope flight inspection standards might be relaxed is indicated to be very considerable along the entire approach path for category service. Relaxation of the standards in ILS approach zone 3 is also possible for category service. An additional finding is that the maximum extent to which flight inspection standards might be relaxed is exactly the same for Category 2 and 3 services.
Author

N76-18087*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BENEFITS OF VTOL AIRCRAFT IN OFFSHORE PETROLEUM LOGISTICS SUPPORT
Darrell E. Wilcox and Michael D. Shovlin Dec. 1975 69 p refs
(NASA-TM-X-73098; A-6360) Avail: NTIS HC $4.50 CSCL 01C

The mission suitability and potential economic benefits of advanced VTOL aircraft were investigated for logistics support of petroleum operations in the North Sea and the Gulf of Mexico. Concepts such as the tilt rotor and lift/cruise fan are promising for future operations beyond 150 miles offshore, where their high cruise efficiency provides savings in trip time, fuel consumption, and capital investment. Depending upon mission requirements, the aircraft operating costs are reduced by as much as 20 percent to 50 percent from those of current helicopters.
Author

N76-18088# Committee on Commerce (U. S. Senate).
LOW-COST AIR TRANSPORTATION ACT
Washington GPO 1975 228 p refs Hearings on S. 421 before Subcomm. on Aviation of Comm. on Commerce, 94th Congr., 1st Sess., 13-14 Feb. 1975
(GPO-52-319) Avail: Subcomm. on Aviation

The hearings concerning low cost air travel are reported with emphasis on charter air service. The Canadian and United Kingdom charter traffic is compared to that of the U.S. Each item of S. 241 is analyzed, and changes, additions, or deletions recommended. CAB regulation concerning discount fares for domestic passengers are discussed. F.O.S.

N76-18089# Stanford Research Inst., Arlington, Va.
THE ECONOMIC IMPACT OF ENERGY SHORTAGES ON COMMERCIAL AIR TRANSPORTATION AND AVIATION MANUFACTURE. VOLUME 1: IMPACT ANALYSIS Final Report
J. E. Gorham, D. Gross, and J. C. Snipes Jun. 1975 259 p refs 2 Vol.
(Contract FEA-C-03-50033-00)
(PB-246271/1; FEA/B-75/588-Vol-1) Avail: NTIS HC $9.00 CSCL 05C

The impact is evaluated of the energy shortage on commercial air transportation and its related manufacturing industries. As a result, the forces are analyzed of change at work in the air transportation industry relating to the energy crisis, both desirable and undesirable, that are likely to affect the way the industry does business, its efficiency or inefficiency in the use of fuel, the impact of continued fuel price increases, and the ability of the industry to use the most fuel-efficient aircraft presently or prospectively available. The cumulative impact is considered of these factors affecting air transportation on the need for, number

of, and timing of requirements for new aircraft in order to assess the secondary impact on the aircraft, engines, and parts manufacturing industries. GRA

N76-18090# Stanford Research Inst., Arlington, Va.
THE ECONOMIC IMPACT OF ENERGY SHORTAGES ON COMMERCIAL AIR TRANSPORTATION AND AVIATION MANUFACTURE. VOLUME 2: AVIATION INDUSTRIES PROFILES AND ENERGY USAGE CHARACTERISTICS Final Report
J. E. Gorham, D. Gross, and J. C. Snipes Jun. 1975 284 p refs 2 Vol.
(Contract FEA-C-03-50033-00)
(PB-246272/9; FEA/B-75/589-Vol-2) Avail: NTIS HC $9.25 CSCL 05C

The results are summarized of the economic impact of energy shortages on commercial air transportation and aviation manufacture. GRA

N76-18091# McDonnell-Douglas Corp., Long Beach, Calif.
BIRD STRIKE ALLEVIATION TECHNIQUES. VOLUME 1: TECHNICAL DISCUSSION Final Report, 18 Feb. 1974 - 18 Feb. 1975
James H. Lawrence, Jr., A. B. Bauer, C. A. Childers, M. J. Coker, and R. K. Eng Feb. 1975 249 p refs
(Contract F33615-74-C-3038; AF Proj. 2202)
(AD-A015803; MDC-J6840-Vol-1; AFFDL-TR-75-2-Vol-1) Avail: NTIS CSCL 01/2

An applicable series of exploratory studies, innovative design concepts, and analytical methods are presented which are associated with techniques to alleviate bird strike hazards to aircraft and crew compartments. In an endeavor to reduce the probability of aircraft/bird mid-air collisions, research was directed to bird deterring and detection systems, crew compartment protection devices, windshield designs, and analytical method for future windshield/supporting structure bird impact designs. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-18092# Federal Aviation Administration, Atlantic City, N.J.
THE CONTROLLER/COMPUTER INTERFACE WITH AN AIR-GROUND DATA LINK, VOLUME 1 Final Report, May-Aug. 1974
S. Rossiter, R. Wiseman (Transportation Systems Center), M. Connelly (MIT), and T. Morgan (Computer Services Corp., Arlington, Va.) Sep. 1975 12 p 2 Vol.
(AD-A017086/0; FAA-NA-74-21-Vol-1;
FAA-RD-75-133-Vol-1) Avail: NTIS HC $3.50 CSCL 17/7

Display techniques and operating procedures that best enable an air traffic controller to work in a mixed voice/digital communications environment are examined. The study focused on the benefits that might accrue to ground-based automatic control through further automation of the controller's communication tasks. A simplified version of the ARTS III Metering and Spacing system was used to assess the controller's communication task when automatically generated control commands were transmitted to voice link or to data link-equipped aircraft in terminal approach traffic. It was concluded that a data link channel efficiently augments the voice channel, the value increasing as the percentage of data link aircraft increases. Results show that further efficiences can be obtained through the use of computer-generated speech, one-at-a-time display of commands moving with the aircraft target symbol, and by the automatic transmission of commands on both the voice and data link channels. The automatic command transmission eliminates the controller's tasks of approving commands, placing more emphasis on traffic situation monitoring. Author

N76-18093# Federal Aviation Administration, Atlantic City, N.J.
THE CONTROLLER/COMPUTER INTERFACE WITH AN AIR-GROUND DATA LINK, VOLUME 2 Final Report, May-Aug. 1974
S. Rossiter, R. Wiseman (Transportation Systems Center), M. Connelly (MIT), and T. Morgan (Computer Services Corp., Arlington, Va.) Sep. 1975 251 p refs 2 Vol.
(AD-A017369/0; FAA-NA-74-21-Vol-2;
FAA-RD-75-133-Vol-2) Avail: NTIS HC $9.00 CSCL 17/7
For abstract, see N76-18093.

N76-18094*# Aerospace Systems, Inc., Burlington, Mass.
FLIGHT TEST AND EVALUATION OF OMEGA NAVIGATION IN A GENERAL AVIATION AIRCRAFT. VOLUME 1: TECHNICAL Final Report, Oct. 1974 - Mar. 1975
Jack D. Howell, William C. Hoffman, Peter V. Hwoschinsky, (MIT), and C. Edward Wischmeyer, (MIT) Apr. 1975 123 p refs
(Contract NAS1-13644)
(NASA-CR-132720; ASI-TR-75-22-Vol-1) Avail: NTIS HC $5.50 CSCL 17G

A low cost flight research program was conducted to evaluate the performance of differential Omega navigation in a general aviation aircraft. The flight program consisted of two distinct parts corresponding to the two major objectives of the study. The Wallops Flight Program was conducted to obtain Omega signal and phase data in the Wallops Flight Center vicinity to provide preliminary technical information and experience in preparation for a comprehensive NASA/FAA flight test program of an experimental differential Omega system. The Northeast Corridor Flight Program was conducted to examine Omega operational suitability and performance on low altitude area navigation (RNAV) routes for city-center to city-center VTOL commercial operations in the Boston-New York-Washington corridor. The development, execution and conclusions of the flight research program are discribed. The results of the study provide both quantitative and qualitative data on the Omega Navigation System under actual operating conditions. Author

N76-18095*# Aerospace Systems, Inc., Burlington, Mass.
FLIGHT TEST AND EVALUATION OF OMEGA NAVIGATION IN A GENERAL AVIATION AIRCRAFT. VOLUME 2: APPENDICES Final Report
Jack D. Howell, William C. Hoffman, Peter V. Hwoschinsky, (MIT), and C. Edward Wischmeyer, (MIT) Apr. 1975 252 p
(Contract NAS1-13644)
(NASA-CR-132721; ASI-TR-75-22-Vol-2) Avail: NTIS HC $9.00 CSCL 17G

Detailed documentation for each flight of the Omega Flight Evaluation study is presented, including flight test description sheets and actual flight data plots. Computer programs used for data processing and flight planning are explained and the data formats utilized by the Custom Interface Unit are summarized. Author

N76-18096# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
DEVELOPMENT OF PROTOTYPE VOR, LOCALIZER, AND GLIDE SLOPE FLIGHT INSPECTION POLARISCOPES. 1: PROGRAM SUMMARY Final Report, Jun. 1972 - May 1975
May 1975 276 p refs
(Contract DOT-FR72WA-3066)
(AD-A019265/8; FAA-RD-75-213-1) Avail: NTIS HC $9.25 CSCL 17/17

A prototype flight inspection polariscope was designed, developed, fabricated, and installed on a Sabreliner 40 flight inspection aircraft. In conjunction with the aircraft's standard receiver and recorder, the polariscope enables the flight inspector to measure the effect of vertically polarized radiations from ground navigation facilities on aircraft course-deviation indicators. The system has the demonstrated capability of measuring with a 0.2 deg accuracy the VOR, localizer, and glide slope signals in the 108 to 118, 108 to 112, and 328 to 335 MHz ranges, respectively. Four major assemblies constitute the polariscope system: (1) VOR/localizer antennas, (2) glide slope antennas,

(3) an RF phase shifter, and (4) a control box. During the system development with scaled antenna models and Sabreliner nose section mock-ups, correct and cross polarization responses were measured and antenna patterns were made in the laboratory and at antenna ranges to evaluate the antenna performance, and the RF phase shifter was evaluated. Author

N76-18097# Technology, Inc., Dayton, Ohio. Instruments and Controls Div.
DEVELOPMENT OF PROTOTYPE VOR, LOCALIZER, AND GLIDE SLOPE FLIGHT INSPECTION POLARISCOPES. 2: BASIC ANTENNA PATTERN DATA. Final Report, Jun. 1972 - May 1975
May 1975 555 p
(Contract DOT-FA72WA-3066)
(AD-A019232/8; FAA-RD-75-213-2) Avail: NTIS HC $13.50 CSCL 17/7

The basic data for the antenna test patterns are presented for the prototype flight inspection polariscope. Author

N76-18098# Systems Technology, Inc., Hawthorne, Calif.
ILS GLIDE SLOPE STANDARDS. PART 2: VALIDATION OF PROPOSED FLIGHT INSPECTION FILTER SYSTEMS AND RESPONSES OF SIMULATED AIRCRAFT ON COUPLED APPROACHES Final Report, 29 Oct. 1974 - 29 Sep. 1975
Lee Gregor Hofmann, John J. Shanahan, and Dunstan Graham Oct. 1975 251 p
(Contract DOT-FA74WA-3340)
(AD-A019295/5; TR-1043-1-2-Pt-2; FAA-RD-74-119-Pt-2) Avail: NTIS HC $8.00 CSCL 01/2

The data base for validation of the longitudinal approach and landing models was presented. The simulation models include: Convair 880 in combination with the Lear Siegler, Inc. (LSI) Automatic Landing System, an inertially augmented version of the LSI System, or a manual flight director version of the LSI System; and Piper PA-30 with an invented coupler and autothrottle system. Simplified simulation models include an aircraft with perfect pitch attitude and airspeed control and a proportional coupler model and an aircraft with perfect rate-of-climb and airspeed control and a proportional-plus-integral coupler model. The simulation models' responses to 9 prototype Glide Slope faults (steps, sinusoids, and specially configured waveforms) and to actual flight inspection differential trace records for 16 ILS Glide Slope facilities are documented. A total of 54 response records for selected simulation models in response to all Glide Slope inputs, and all simulation models in response to selected Glide Slope inputs are given. Author

N76-18099# White Sands Missile Range, N.Mex. Instrumentation Directorate.
INTERNAL-RANGE INSTRUMENTED HYBRID NAVIGATION SYSTEMS
R. E. Green and N. N. Puri Aug. 1975 67 p refs
(DA Proj. 1U8-65804-DE-93)
(AD-A016099; STEWS-ID-75-1) Avail: NTIS CSCL 17/7

The report discusses a Hybrid Navigational System for low altitude airborne tracking and for accurate calibration of range instrumentation equipment. System consists of an airborne inertial platform, transponder for Distance Measuring Equipment (DME) interrogation (providing range and range measurements), barometer type altimeter or a phase array radar, an airborne navigational and filtering computer, and ground based DME. Inertial platform may or may not be torqued. The heart of the system is the navigational computer and the Kalman filter. A reference trajectory is generated by the cubic spline method and along with proper coordinate conversion, the doppler data, range measurements data, barometer data, and the inertial measurement unit (IMU) accelerometer measurements corrupted with noise are simulated. Navigational equations, error equations, and the Kalman filter algorithm are mechanized. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.
For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-18100*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN DEFINITION STUDY OF A NASA/NAVY LIFT/CRUISE FAN TECHNOLOGY V/STOL AIRPLANE: RISK ASSESSMENT ADDENDUM TO THE FINAL REPORT
J. M. Zabinsky, R. W. Burnham, C. C. Flora, P. Gotlieb, D. L. Grande, D. W. Gunnarson, W. M. Howard, D. Hunt, G. W. Jakubowski, P. E. Johnson et al Jun. 1975 48 p refs
(Contract NAS2-6563)
(NASA-CR-137729; D6-42611-Add) Avail: NTIS HC $4.00 CSCL 01C

An assessment of risk, in terms of delivery delays, cost overrun, and performance achievement, associated with the V/STOL technology airplane is presented. The risk is discussed in terms of weight, structure, aerodynamics, propulsion, mechanical drive, and flight controls. The analysis ensures that risks associated with the design and development of the airplane will be eliminated in the course of the program and a useful technology airplane that meets the predicted cost, schedule, and performance can be produced. Author

N76-18101*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN DEFINITION STUDY OF A LIFT/CRUISE FAN TECHNOLOGY V/STOL AIRPLANE: SUMMARY Final Report
J. M. Zabinsky and H. C. Higgins 15 Aug. 1975 104 p
(Contract NAS2-6563)
(NASA-CR-137749; D6-42647) Avail: NTIS HC $5.50 CSCL 01C

A two-engine three-fan V/STOL airplane was designed to fulfill naval operational requirements. A multimission airplane was developed from study of specific point designs. Based on the multimission concept, airplanes were designed to demonstrate and develop the technology and operational procedures for this class of aircraft. Use of interconnected variable pitch fans led to a good balance between high thrust with responsive control and efficient thrust at cruise speeds. The airplanes and their characteristics are presented. Author

N76-18102*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN DEFINITION STUDY OF A LIFT/CRUISE FAN TECHNOLOGY V/STOL AIRPLANE: ADDENDUM Final Report
J. M. Zabinsky and H. C. Higgins 15 Aug. 1975 312 p refs
(Contract NAS2-6563)
(NASA-CR-137750; D6-42647) Avail: NTIS HC $9.75 CSCL 01C

For abstract, see N76-18101.

N76-18103*# McDonnell Aircraft Co., St. Louis, Mo.
STUDY OF FAIL-SAFE ABORT SYSTEM FOR AN ACTIVELY COOLED HYPERSONIC AIRCRAFT, VOLUME 2 Final Report
M. E. Peeples and R. L. Herring Jan. 1976 229 p refs
(Contract NAS1-13631)
(NASA-CR-144920; MDC-A3313-Vol-2) Avail: NTIS HC $8.00 CSCL 01C

Conceptual designs of a fail-safe abort system for hydrogen fueled actively cooled high speed aircraft are examined. The fail-safe concept depends on basically three factors: (1) a reliable method of detecting a failure or malfunction in the active cooling system, (2) the optimization of abort trajectories which minimize the descent heat load to the aircraft, and (3) fail-safe thermostructural concepts to minimize both the weight and the maximum temperature the structure will reach during descent. These factors are examined and promising approaches are evaluated based on weight, reliability, ease of manufacture and cost. Author

N76-18104# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
AN EXPERIMENTAL STUDY ABOUT THE EFFECT OF

THRESHOLDS ON C. G. ACCELERATION COUNTINGS OBTAINED FROM A MILITARY AIRPLANE
O. Buxbaum and V. Ladda 1975 26 p refs Sponsored by Min. of Defense
(TB-123(1975)) Avail: NTIS HC $4.00

The C. G. vertical accelerations of a military airplane, which were recorded continuously on magnetic type during flight operation in two types of missions, were analyzed statistically by means of a digital computer; the different counting procedures of acceleration counting systems as used by various countries for fatigue life monitoring of aircraft were simulated. The results are presented in form of cumulative frequency distributions and were critically valued. Author

N76-18105*# McDonnell Aircraft Co., St. Louis, Mo.
DESIGN DEFINITION STUDY OF A LIFE/CRUISE FAN TECHNOLOGY V/STOL AIRCRAFT. VOLUME 2, ADDENDUM 2: PROGRAM RISK ASSESSMENT
Jul. 1975 44 p
(Contract NAS2-5499)
(NASA-CR-137728; MDC-A3440-Vol-2-Add-2) Avail: NTIS HC $4.00 CSCL 01C

The results are presented of a risk assessment study conducted on two technology aircraft. The aircraft system components were reviewed and assessed for risk based on: (1) complexity relative to state-of-the-art, (2) manufacturing and qualification testing, (3) availability and delays, and (4) cost/schedule impact. These assessments were based on five risk nomenclatures: low, minor, moderate, high, and extreme. Each aircraft system was assigned an overall risk rating depending upon its contribution to the capability of the aircraft to achieve the performance goals. The slightly lower Sabreliner performance margin is due to the restricted flight envelope, the fixed landing gear, and internal fuel capacity. The Sabreliner with retractable gear and allowed to fly at its best speed and altitude would reflect performance margins similar to the New Airframe. These significant margins, inherent with the MCAIR three gas generator/three fan propulsion system, are major modifiers to risk assessment of both aircraft. The estimated risk and the associated key system and performance areas are tabulated. Author

N76-18106*# Rockwell International Corp., Los Angeles, Calif.
DESIGN DEFINITION STUDY OF NASA/NAVY LIFT/CRUISE FAN V/STOL AIRCRAFT Supplemental Report - Technology Aircraft Risk Assessment
Sep. 1975 41 p
(Contract NAS2-6564)
(NASA-CR-137727) Avail: NTIS HC $4.00 CSCL 01C

Assessed are the risks associated with the lift/cruise fan technology V/STOL aircraft program. Three candidate concepts for the technology aircraft design approach are considered: the lowspeed only modification, the full performance modification, and the all new aircraft concepts. Survey results indicate that the lift/cruise fan technology aircraft program is feasible, from the standpoint of technical risk, with some evidence of uncertainty of meeting the planned schedule and relatively minor impact on estimated program costs. Author

N76-18107*# Bell Helicopter Co., Fort Worth, Tex.
ANALYSIS OF THE WIND TUNNEL TEST OF A TILT ROTOR POWER FORCE MODEL Final Report
R. L. Marr, D. G. Ford, and S. W. Ferguson 1 Jun. 1974 137 p refs
(Contract NAS2-8084)
(NASA-CR-137529; Rept-301-099-004) Avail: NTIS HC $6.00 CSCL 01C

Two series of wind tunnel tests were made to determine performance, stability and control, and rotor wake interaction on the airframe, using a one-tenth scale powered force model of a tilt rotor aircraft. Testing covered hover (IGE/OCE), helicopter, conversion, and airplane flight configurations. Forces and moments were recorded for the model from predetermined trim attitudes. Control positions were adjusted to trim flight (one-g lift, pitching moment and drag zero) within the uncorrected test data balance accuracy. Pitch and yaw sweeps were made about the trim attitudes with the control held at the trimmed settings to determine the static stability characteristics. Tail on, tail off, rotors on, and rotors off configurations were testes to determine the rotor wake effects on the empennage. Results are presented and discussed. Author

N76-18108# Advisory Group for Aerospace Research and Development, Paris (France).
CURRENT STANDARDS OF FATIGUE TEST ON STRIKE AIRCRAFT
R. D. J. Maxwell (RAE, Farnborough, Engl.) Jan. 1976 13 p refs
(AGARD-AR-92; ISBN-92-835-1205-7) Avail: NTIS HC $3.50

The major fatigue test constitutes one of the most important aspects in almost all modern tactical aircraft designs. Within NATO, where numerous different tactical aircraft are employed, and where several user nations may operate an aircraft built by a different nation, it is important that the major fatigue test be performed in such a manner that the results can be interpreted and used by the various countries concerned. This Advisory Report, therefore, presents a statement of the objectives of a fatigue test, a list of essential steps needed to achieve the objectives, a summary of recommendations of the way the steps should be carried out and a review of the background philosophy behind the recommendations. Author

N76-18109# Saint Louis Univ., Cahokia, Ill.
CRITICAL PARTS PROGRAM UH-1H, AH-1G, OH-6A, OH-58A, CH-47, AND CH-54 AIRCRAFT Final Report, 1 Jul. 1974 - 24 Aug. 1975
William E. Brand, Richard L. Humphrey, and John P. Diani 22 Aug. 1975 326 p refs
(Contract DAAJ01-74-C-1017)
(AD-A016126; USAAVSCOM-TR-75-42) Avail: NTIS CSCL 01/3

A three-phase Critical Parts Program on the UH-1H, AH-1G, OH-6A, OH-58A, CH-47, and CH-54 aircraft, was implemented to: identify parts that had malfunctioned and subsequently caused a flight abort, identify the mode of failure with regard to the identified items, and determine those characteristics of a part that should be closely controlled during manufacture. Of all six aircraft, during specific time periods, the greatest problem areas lie in the engine and transmission systems. The chip detector reports indicate that the chip detectors are functioning properly about 50 percent of the time. Also, less than 16.5 percent of the parts subjected for analysis at CCAD could be identified to an accident report, for each type of aircraft. GRA

N76-18110# California Univ., Los Angeles. Dept. of Mechanics and Structures.
APPLICATION OF OPTIMALITY CRITERIA TO STRESS LIMITED STRUCTURAL DESIGN Interim Report
M. W. Dobbs and R. B. Nelson May 1975 48 p refs
(Grant AF-AFOSR-2640-74; AF Proj. 9782)
(AD-A015855; UCLA-ENG-7533; AFOSR-75-1431TR) Avail: NTIS CSCL 01/3

This report presents a recursive design method for the minimum weight design of linear elastic redundant structures subject to multiple independent static loading conditions and with behavioral constraints on allowable internal stresses and side constraints on design variables. This recursive method is based on the Kuhn-Tucker test for a local optimum and gives, upon completion, a true local optimum design. In this method the values of the design variables are modified to drive the design to a point in the design space satisfying the Kuhn-Tucker test. Satisfaction of the Kuhn-Tucker test requires knowledge of which constraints are active, that is, critical at the optimum design. Selecting the set of active constraints for stress limited design is difficult because many more stress constraints exist than are active in the final design. Therefore, one or more iterations or redesigns are necessary. The recursive method presented herein allows automatic constraint selection and requires only the solution of a set of simultaneous linear algebraic equations at each iteration. The results of the application of the recursive method to several well known truss type structures are shown to compare favorably to results obtained using mathematical programming and other optimality criteria methods. GRA

N76-18111# Cobro Corp., Silver Spring, Md.
RMAC ANALYSIS OF CH-47 HELICOPTER Final Report,

1 Jul. 1974 - 15 Aug. 1975
15 Aug. 1975 73 p
(Contract DAAJ01-74-C-1025)
(AD-A016117; USAAVSCOM-TR-75-38) Avail: NTIS CSCL 01/3

An in-depth analysis was made of the reliability, availability, maintainability and cost of the CH-47 helicopter. The study was based on available Army documentation of the A, B, and Coversions of the helicopter design; the record of component failures and removals as reflected in the Army's RAMMIT Major Item Removal Frequency (MIRF) reports; the system mission and plan for use; the Disassembly and Inspection Reports covering engineering assessment of removed failed components; and the costs in material, labor and time stemming from removal/replacement of a component. The analysis was carried out using the Army's computerized Analytic Methodology for System Evaluation and Control (AMSEC), together with special techniques and algorithms which were developed as required. The report provides, for the system and for each component of each version, the current RMAC assessment; a cross-comparison between the three versions; an analysis of the impact on RMAC of changes in maintenance plans, or of different costs of mission failure; and an interpretation of DIR information as it bears on RMAC.
GRA

N76-18112# McDonnell Aircraft Co., St. Louis, Mo.
INTERFACE OF FIGHTER THROTTLE/ENERGY MANAGEMENT FUNCTIONS WITH DAIS Final Report, 22 May 1974 - 30 Apr. 1975
G. G. Grose, R. G. Marsh, and R. D. Turner Jun. 1975 143 p refs
(Contract F33615-74-C-3103; AF Proj. 2049)
(AD-A015804; AFFDL-TR-75-60) Avail: NTIS CSCL 01/2

A throttle/energy management (T/EM) concept for fuel, range, time optimization was extended by application to the Air Force Digital Avionics Information System (DAIS). The current state-of-technology of automatic throttles was reviewed, considering features applicable to a T/EM system. The functional requirements of a T/EM system for fighter aircraft were defined, based on analysis of the aircraft characteristics and flight control system of the Advanced Development Program 680J configured F-4. Computational algorithms and control laws were developed by digital simulation. The T/EM system uses stored data for a limited set of optimal acceleration, dash and descent segments, from which the control commands and performance for a specific mission would be calculated.
GRA

N76-18113# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
A METHOD FOR DETERMINING AERODYNAMIC CHARACTERISTICS FOR MISSION COMPLETION STUDIES IN A NUCLEAR ENVIRONMENT Final Technical Report, 15 Jan. - 1 Apr. 1974
Robert R. Snodgrass Jul. 1975 48 p refs
(AD-A015745; ASD-TR-75-3) Avail: NTIS CSCL 15/6

The existence of a nuclear bomb minimum miss distance which will permit mission completion has been discussed for a number of years. This study, for the first time, endeavors to define the mission essential aerodynamics associated with a mission completion study. Although this study is specifically directed toward the KC-135A, it contains the essential requirements for a general study on any system. Ground rules and assumptions are presented for defining the characteristics which would be associated with the aerodynamics of a nuclear blast degraded system. This approach to mission completion can be made with a sequence of aerodynamic responses to structural damage due to the nuclear blast environment associated with burst distances. This damage is then related to the degraded aircraft performance and its ability to continue the mission.
Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-18114*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPERATIONAL DESCRIPTION OF AN EXPERIMENTAL DIGITAL AVIONICS SYSTEM FOR STOL AIRPLANES
Frank Neuman, Delamar M. Watson, and Peter Bradbury Dec. 1975 59 p refs Prepared in cooperation with Sperry Flight Systems, Phoenix, Ariz.
(NASA-TM-X-62448; A-6127) Avail: NTIS HC $4.50 CSCL 01D

The operation is described of an experimental integrated digital STOL avionics system. The system is capable of automatic 4D guidance and navigation in the terminal area, following preprogrammed curved flightpaths plus automatic approach and landing, guided by a microwave landing system. In addition, the system includes the standard autopilot and manual modes of operation. The information content of the electronic displays and of the mechanical display is described. Functional descriptions of the input/output devices are given. These devices include the mode select panel, status panel, keyboard, and the force-sensing column for control wheel steering. The system has been used in three research airplanes, as well as in a comprehensive simulation facility.
Author

N76-18115*# Mississippi State Univ., Mississippi State. Aerophysics and Aerospace Engineering.
FLIGHT TEST OF A STALL SENSOR AND EVALUATION OF ITS APPLICATION TO AN AIRCRAFT STALL DETERRENT SYSTEM USING THE NASA LRC GENERAL AVIATION SIMULATOR Semiannual Status Report, 15 Sep. 1975 - 15 Feb. 1976
George Bennett 5 Mar. 1976 49 p
(Grant NsG-1249)
(NASA-CR-146324) Avail: NTIS HC $4.00 CSCL 14B

A series of flight maneuvers were developed to cover the range of flight conditions and to define the repeatability and hysteresis of the sensors. Initial flights were made with two sensors at the + or - 68 percent span and 60 percent and 70 percent chord stations. The primary effort in simulation program development was to modify the LRC General Aviation Simulator (GAS) Fortran programs to allow execution on the MSU UNIVAC 1106. A simple model of the sensor-servo stall deterrent system was developed. A one degree of freedom model of pitch dynamics of the airplane and stall deterrent system was developed to make initial estimates of the control system gains. A position error plus rate damping control algorithm was found to have acceptable characteristics.
Author

N76-18116# Mantech of New Jersey, Rockville, Md.
AVIONICS MODULE REPAIR IMPROVEMENT PROGRAM, MANAGEMENT INFORMATION SYSTEM (AMRIP-MIS) Final Report
Stephen S. Wood and Randall R. Moore (Weapon Systems Analysis Dept., Washington, D. C.) Jun. 1975 125 p Sponsored by Navy
(AD-A015645; NAVWESA-R-7508) Avail: NTIS CSCL 01/3

This report describes an automated Management Information System for the Avionics Module Repair Improvement Program (AMRIP-MIS). The system permits the maintenance of updated files on AMRIP-certified personnel, equipment, and repair facilities. It also has the capability of providing management with selected summaries that may be used as timely status reports or to schedule training, periodic recertification of personnel and repair facilities, and delivery of equipment.
GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-18117* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CASCADE PLUG NOZZLE Patent
Blake W. Corson, Jr., inventor (to NASA) Issued 17 Feb. 1976 9 p Filed 12 Jul. 1974 Continuation-in-part of abandoned US Patent Appl. SN-331759, filed 13 Feb. 1973
(NASA-Case-LAR-11674-1; US-Patent-3,938,742; US-Patent-Appl-SN-488616; US-Patent-Class-239-265.11; US-Patent-Class-181-33HC; US-Patent-Appl-SN-331759) Avail: US Patent Office CSCL 21E

An exhaust nozzle for a jet aircraft which provides jet noise suppression is described. The nozzle includes a plurality of coaxial airfoil ring segments which are spaced serially along the longitudinal axis of the nozzle to define a plurality of annular coaxial channels. The diameters of the segments progressively decrease downstream along this axis and the exits of the channels are non-coplanar. The radial depths of the channels are small as compared with the axial distance between adjacent channel exits so that noise is emitted nonsimultaneously from the channel exits as a series of weakened pulses staggered in time. The boattail angles of the outer surfaces of the ring airfoil segments increase in magnitude with increasing distance downstream to reduce drag. Official Gazette of the U.S. Patent Office

N76-18118*# Boeing Commercial Airplane Co., Seattle, Wash.
PHASE 2 PROGRAM ON GROUND TEST OF REFANNED JT8D TURBOFAN ENGINES AND NACELLES FOR THE 727 AIRPLANE. VOLUME 1: SUMMARY Final Report
Dec. 1975 58 p refs 4 Vol.
(Contract NAS3-17842)
(NASA-CR-134797; BCAC-D6-42440-1-Vol-1) Avail: NTIS HC $4.50 CSCL 21E

The propulsion performance, acoustic, structural, and systems changes to a 727-200 airplane retrofitted with a refan modification of the JT8D turbofan engine are evaluated. Model tests, design of certifiable airplane retrofit kit hardware, manufacture of test hardware, ground test of a current production JT8D engine, followed by test of the same engine modified to the refan configuration, detailed analyses of the retrofit impact on airplane airworthiness, performance, and noise, and a preliminary analysis of retrofit costs are included. Results indicate that the refan retrofit of the 727-200 would be certifiable and would result in a 6-to 8 EPNdb reduction in effective perceived noise level (EPNL) at the FAR 36 measuring points and an annoyance-weighted footprint area reduction of 68% to 83%. The installed refan engine is estimated to provide 14% greater takeoff thrust at zero velocity and 10% greater thrust at 100 kn (51.4 m/s). There would be an approximate 0.6% increase in cruise specific fuel consumption (SFC). The refan engine performance in conjunction with the increase in stalled weight results in a range reduction of approximately 15% over the unmodified airplane at the same brake release gross weight (BRGW), with a block fuel increase of 1.5% to 3%. With the particular model 727 that was studied, however, it is possible to operate the airplane (with minor structural modifications) at a higher BRGW and increase the range up to approximately 15% relative to the nonrefanned airplane (with equal or slightly increased noise levels). The JT8D refan engine also improves the limited-field range of the airplane. Author

N76-18119*# Boeing Commercial Airplane Co., Seattle, Wash.
PHASE 2 PROGRAM ON GROUND TEST OF REFANNED JT8D TURBOFAN ENGINES AND NACELLES FOR THE 727 AIRPLANE. VOLUME 2: HARDWARE DESIGN AND MANUFACTURING Final Report
Dec. 1975 197 p refs 4 Vol.
(Contract NAS3-17842)
(NASA-CR-134798; BCAC-D6-42440-2-Vol-2) Avail: NTIS HC $7.50 CSCL 21E
For abstract, see N76-18118.

N76-18120*# Washington Univ., Seattle. Dept. of Mechanical Engineering.
A STUDY OF SOUND GENERATION IN SUBSONIC ROTORS, VOLUME 1 Final Report
J. D. Chalupnik and L. T. Clark [1975] 159 p refs
(Grant NGR-48-002-144)
(NASA-CR-146349; ME-73-11-Vol-1) Avail: NTIS HC $6.75 CSCL 20A

A model for the prediction of wake related sound generation by a single airfoil is presented. It is assumed that the net force fluctuation on an airfoil may be expressed in terms of the net momentum fluctuation in the near wake of the airfoil. The forcing function for sound generation depends on the spectra of the two point velocity correlations in the turbulent region near the airfoil trailing edge. The spectra of the two point velocity correlations were measured for the longitudinal and transverse components of turbulence in the wake of a 91.4 cm chord airfoil. A scaling procedure was developed using the turbulent boundary layer thickness. The model was then used to predict the radiated sound from a 5.1 cm chord airfoil. Agreement between the predicted and measured sound radiation spectra was good. The single airfoil results were extended to a rotor geometry, and various aerodynamic parameters were studied. Author

N76-18121*# Washington Univ., Seattle. Dept. of Mechanical Engineering.
A STUDY OF SOUND GENERATION IN SUBSONIC ROTORS, VOLUME 2 Final Report
J. D. Chalupnik and L. T. Clark [1975] 63 p refs
(Grant NGR-48-002-144)
(NASA-CR-146420; ME-73-11-Vol-2) Avail: NTIS HC $4.50 CSCL 20A

Computer programs were developed for use in the analysis of sound generation by subsonic rotors. Program AIRFOIL computes the spectrum of radiated sound from a single airfoil immersed in a laminar flow field. Program ROTOR extends this to a rotating frame, and provides a model for sound generation in subsonic rotors. The program also computes tone sound generation due to steady state forces on the blades. Program TONE uses a moving source analysis to generate a time series for an array of forces moving in a circular path. The resultant time series are than Fourier transformed to render the results in spectral form. Program SDATA is a standard time series analysis package. It reads in two discrete time series and forms auto and cross covariances and normalizes these to form correlations. The program then transforms the covariances to yield auto and cross power spectra by means of a Fourier transformation.
Author

N76-18122*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A 1.57 PRESSURE-RATIO TRANSONIC FAN STAGE WITH A SCREEN-INDUCED 90 DEG CIRCUMFERENTIAL INLET FLOW DISTORTION
Nelson L. Sanger Washington Feb. 1976 76 p refs
(NASA-TN-D-8163; E-8218) Avail: NTIS HC $5.00 CSCL 21E

A transonic fan stage having a design pressure ratio of 1.57 was tested with a 90 degree circumferential distortion imposed on the inlet flow. The rotor diameter was approximately 50.8 cm, and the design pressure ratio was 1.60 at a tip speed of 425 m/sec. Overall performance at 70 and 100 percent of design speed showed a loss of stall pressure ratio and flow range at design speed and no significant loss in stall pressure ratio at 70 percent of design speed. Detailed flow measurements are presented to show the rotor-upstream flow interactions and the attenuation and amplification properties through the stage.
Author

N76-18123*# Avco Lycoming Div., Stratford, Conn.
SELF-ACTING SEALS FOR HELICOPTER ENGINES
Peter Lynwander Oct. 1975 119 p refs
(Contract NAS3-18015)
(NASA-CR-134940; LYC-75-78) Avail: NTIS HC $5.50 CSCL 21E

An experimental evaluation was conducted with NASA-designed self-acting face and circumferential seals for use in the main shaft positions of advanced gas turbine engines. The seals featured Rayleigh step pads (self-acting geometry) for lift augmentation. The tested seals incorporated design improvements over previous self-acting configurations. Self-acting face seals were tested to speeds of 214 m/s (700 ft/sec, 63700 rpm), air pressures of 216.8 N/sq cm abs (314.7 psia), and air temperatures of 688K (778 F). Self-acting circumferential seals were tested to speeds of 183 m/s (600 ft/sec, 47700 rpm), air pressures of 61.8 N/sq cm abs (89.7 psia), and air temperatures of 711 K (820 F). Self-acting face-seals are capable of operating at conditions exceeding conventional seal capability. The limit on speed capability was found to be the flatness of the seal-seat. The self-acting circumferential seal design tested requires further development for use in advanced engines.
Author

N76-18124# Committee on Science and Technology (U. S. House).
AIRCRAFT NOISE ABATEMENT TECHNOLOGY
Washington GPO 1976 27 p Rept. by Subcomm. on Aviation and Transportation R and D of Comm. on Sci. and Technol., 94th Congr., 2d Sess., Feb. 1976
(GPO-66-059) Avail: Subcomm. on Aviation and Transportation R and D

The status of research and development in aircraft noise abatement is reviewed. Emphasis is placed on coordinating the near term implementation of noise reduction technology with the longer terms efforts. Interrelated factors including public health and welfare as well as technological and economic capabilities are considered. Conclusions and recommendations are summarized.
J.M.S.

N76-18125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCES IN TURBINE BLADE TEMPERATURE MEASUREMENTS
Frank G. Pollack 1976 8 p refs Proposed for presentation at the 22nd Intern. Instrumentation Symp., San Diego, Calif., 25-27 May 1976; sponsored by Instr. Soc. of Am.
(NASA-TM-X-71878; E-8652) Avail: NTIS HC $3.50 CSCL 21E

Radiation pyrometry principles and imaging methods like photography and photoelectric scanning are combined to make accurate research quality temperature measurements on turbine airfoils. Two systems are described for obtaining detailed temperature distribution measurements: an infrared photographic system for stationary vanes and a photoelectric scanning system for rotating blades. An overview is presented outlining the design, calibration methods, and recent test results.
Author

N76-18126*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXHAUST EMISSION CALIBRATION OF TWO J-58 AFTERBURNING TURBOJET ENGINES AT SIMULATED HIGH-ALTITUDE, SUPERSONIC FLIGHT CONDITIONS
James D. Holdeman Washington Feb. 1976 73 p refs
(NASA-TN-D-8173; E-8490) Avail: NTIS HC $4.50 CSCL 21E

Emissions of total oxides of nitrogen, nitric oxide, unburned hydrocarbons, carbon monoxide, and carbon dioxide from two J-58 afterburning turbojet engines at simulated high-altitude flight conditions are reported. Test conditions included flight speeds from Mach 2 to 3 at altitudes from 16.0 to 23.5 km. For each flight condition exhaust measurements were made for four or five power levels, from maximum power without afterburning through maximum afterburning. The data show that exhaust emissions vary with flight speed, altitude, power level, and radial position across the exhaust. Oxides of nitrogen emissions decreased with increasing altitude and increased with increasing flight speed. Oxides of nitrogen emission indices with afterburning were less than half the value without afterburning. Carbon monoxide and hydrocarbon emissions increased with increasing altitude and decreased with increasing flight speed. Emissions of these species were substantially higher with afterburning than without.
Author

N76-18127*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INCIDENCE ANGLE BOUNDS FOR LIP FLOW SEPARATION OF THREE 13.97-CENTIMETER-DIAMETER INLETS
Roger W. Luidens and John M. Abbott Washington Feb. 1976 16 p refs
(NASA-TM-X-3351; E-8523) Avail: NTIS HC $3.50 CSCL 01C

Low speed wind tunnel tests were conducted to establish a procedure for determining inlet-lip flow separation and to make preliminary examination of the incidence angle bounds for lip flow separation on inlets intended for the nacelles of STOL (short takeoff and landing) aircraft. Three inlets were tested. Two of the inlets had short centerbodies with lower lip area contraction ratios of 1.30 and 1.44. The third inlet had a cylindrical centerbody extended forward into the inlet throat with a lower lip area contraction ratio of 1.44. The inlets were sized to fit a 13.97 centimeter-diameter fan. For inlet throat Mach numbers less than about 0.43, the lip flow separation angle was increased by either increasing the ratio of throat velocity to freestream velocity (Vt/Vo) or by increasing the lower lip area contraction ratio. For throat Mach numbers greater than a certain value (ranging from 0.43 to 0.52), increasing throat Mach number in some cases resulted in a decrease in the lip flow separation angle. Extending a cylindrical centerbody into the inlet throat increased the flow separation angle for nearly all values of Vt/Vo.
Author

N76-18128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT VELOCITY EFFECTS ON EXHAUST NOISE OF A WEDGE NOZZLE INSTALLED ON AN UNDERWING NACELLE ON AN F-106 AIRPLANE
Richard R. Burley Washington Feb. 1976 31 p refs
(NASA-TM-X-3361; E-8548) Avail: NTIS HC $4.00 CSCL 20A

It is important to know whether the relatively high takeoff speeds of supersonic transport aircraft will change the exhaust noise levels of nozzles from those measured at static conditions. To gain some insight into this question, a modified F-106B aircraft was used to conduct flyover and static tests on a wedge nozzle. Flight velocity had an adverse effect on exhaust noise when compared with static results at the same relative jet velocity but a beneficial effect when compared with static results at the same absolute jet velocity. The wedge nozzle, which has a two-dimensional wedge surface rather than an axisymmetric plug surface, had a higher peak flyover noise level than the plug nozzle.
Author

N76-18129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT-TRANSFER CHARACTERISTICS OF PARTIALLY FILM COOLED PLUG NOZZLE ON A J-85 AFTERBURNING TURBOJET ENGINE
Stanley M. Nosek and David M. Straight Washington Mar. 1976 31 p refs
(NASA-TM-X-3362; E-8553) Avail: NTIS HC $4.00 CSCL 21E

Plug nozzle film cooling data were obtained downstream of a slot located at 42 percent of the total plug length on a J-85 engine. Film cooling reduced the aft end wall temperature as much as 150 K, reduced total pressure loss in the upstream convection cooling passages by 50 percent, and reduced estimated compressor bleed flow requirement by 14 percent compared to an all convectively cooled nozzle. Shock waves along the plug surface strongly influenced temperature distributions on both convection and film cooled portions. The effect was most severe at nozzle pressure ratios below 10 where adverse pressure gradients were most severe.
Author

N76-18130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC AND AERODYNAMIC PERFORMANCE OF A 1.83-METER (6-FT) DIAMETER 1.25-PRESSURE-RATIO FAN (QF-8)
Richard P. Woodward and James G. Lucas Washington Feb. 1976 106 p refs
(NASA-TN-D-8130; E-8431) Avail: NTIS HC $5.50 CSCL 21E

A 1.25-pressure-ratio 1.83-meter (6-ft) tip diameter experimental fan stage with characteristics suitable for engine application on STOL aircraft was tested for acoustic and aerodynamic performance. The design incorporated proven features for low noise, including absence of inlet guide vanes, low rotor blade tip speed, low aerodynamic blade loading, and long axial spacing between the rotor and stator blade rows. The fan was operated with five exhaust nozzle areas. The stage noise levels generally increased with a decrease in nozzle area. Separation of the acoustic one-third octave results into broadband and pure-tone components showed the broadband noise to be greater than the corresponding pure-tone components. The sideline perceived noise was highest in the rear quadrants. The acoustic results of QF-8 were compared with those of two similar STOL application fans in the test series. The QF-8 had somewhat higher relative noise levels than those of the other two fans. The aerodynamic results of QF-8 and the other two fans were compared with corresponding results from 50.8-cm (20-in.) diam scale models of these fans and design values. Although the results for the full-scale and scale models of the other two fans were in reasonable agreement for each design, the full-scale fan QF-8 results showed poor performance compared with corresponding model results and design expectations. Facility effects of the full-scale fan QF-8 installation were considered in analyzing this discrepancy. Author

N76-18131*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NOISE SUPPRESSOR FOR TURBO FAN JET ENGINES Patent Application
Dah Yu Cheng, inventor (to NASA) (Santa Clara Univ.) Filed 13 Feb. 1976 17 p Sponsored by NASA
(NASA-Case-ARC-10812-1; US-Patent-Appl-SN-657903) Avail: NTIS HC $3.50 CSCL 21E

A noise suppressor for installation on the discharge or aft end of a turbofan engine is described. Within the suppressor are fixed annular airfoils which are positioned to reduce the relative velocity between the high temperature fast moving jet exhaust and the low temperature slow moving air. Within the suppressor nacelle is an exhaust jet nozzle which constrains the shape of the jet exhaust to a substantially uniform elongate shape irrespective of the power setting of the engine. Fixed ring airfoils within the suppressor nacelle have the same salutary effects irrespective of the power setting at which the engine is operated. NASA

N76-18132# Booz-Allen Applied Research, Inc., Bethesda, Md.
ANALYSIS OF THE EFFECT OF CONCORDE AIRCRAFT NOISE ON HISTORIC STRUCTURES Final Report
Robert L. Hershey, Russ J. Kevala, and Sharon L. Burns Washington FAA Jul. 1975 77 p refs
(Contract DOT-FA75WA-3720)
(AD-A017082/9; FAA-RD-75-118) Avail: NTIS HC $5.00 CSCL 20/1

Statistical estimates of breakage probabilities from noise induced vibration were calculated for susceptible structural elements at five historic sites near the proposed subsonic flight path of the Concorde aircraft. The structural features analyzed included windows, brick chimneys, stone bridge, and a plaster ceiling. The calculated breakage probabilities for these features were generally less than .001 for a year of projected Concorde overflights. This is considerably below the failure rate that would be expected just from exposure to the weather. The only exception to this was the probability of breakage of lites of glass at Sully Plantation which were already cracked and are expected to be replaced. The method of calculation used in this study was the response probability density function technique which has been used in previous studies of structural response to aircraft noise. Author

N76-18133# National Aerospace Lab., Tokyo (Japan).
NEW MOLDING METHOD AT THREE-DIMENSIONAL HOLLOW PHOTOELASTIC MODEL AND CENTRIFUGAL STRESS ANALYSES OF AIR-COOLED TURBINE BLADES
Toyoaki Yoshida, Katsutoshi Matsusue, Kitao Takahara, and Ryosaku Hashimoto Sep. 1975 26 p refs In JAPANESE; ENGLISH summary
(NAL-TR-427) Avail: NTIS HC $4.00

A new method of molding a three-dimensional hollow photoelastic model was developed and centrifugal stress analyses of air-cooled turbine blade models molded by this method were performed. The distinctive feature of the molding process consists in the method of manufacturing and removing the core. The basic core is manufactured first from wax, then coated with copper by electro plating. After casting and hardening epoxy resin outside the metal coated core, the basic core material is melted by heated air and removed, and finally the coating metal left inside the model is removed by chemical etching. Silicone rubber can be used successfully as material for molding the model and the basic core. Stress caused by centrifugal force in air-cooled turbine blade models manufactured by this technique were analyzed by photoelastic tests using the stress freezing method. The greatest stress occurred in the vicinity of the dovetail, and no significant difference was observed between the greatest value in the solid blade and in the hollow blade. Author

N76-18134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE GENERATED BY QUIET ENGINE FANS. 3: FAN C
Francis J. Montegan, John W. Schaefer, and Ralph F. Schmiedlin Washington Mar. 1976 79 p refs
(NASA-TM-X-3360; E-8530) Avail: NTIS HC $5.00 CSCL 21E

A family of fans designed with low noise features was acoustically evaluated, and noise results are documented for a 1.6-pressure-ratio, 472-m/sec (155-ft/sec) tip speed fan. The fan is described and some aerodynamic operating data are given. Far field noise around the fan was measured over a range of operating conditions for a variety of configurations having different arrangements of sound absorbing material in the flow ducts. Complete results of 1.3 octave band analysis of the data are presented in tabular form. Included also are acoustic power spectra and sideline perceived noise levels. Representative 1/3 octave band data are presented graphically, and sample graphs of continuous narrow band spectra are also provided. Author

N76-18135# Army Aviation Systems Command, St. Louis, Mo.
HEAVY LIFT HELICOPTER ENGINE DEVELOPMENT PROGRAM DESIGN TO COST, 2ND PERIOD AWARD FEE EVALUATION REPORT Final Report
Conrad W. Faber Aug. 1975 56 p
(DA Proj. 1X2-63203-DB-75)
(AD-A016120; USAAVSCOM-TR-75-41) Avail: NTIS CSCL 01/3

During development of a 8079 shaft horsepower gas turbine engine, the contractor performed an extensive design to cost effort under an award fee provision. This report summarizes the government's evaluation of this effort and includes a description of the contractor's design to cost policy and procedures. GRA

N76-18136# Boeing Co., Wichita, Kans.
MECHANICAL POWER PACKAGE FOR AIRCRAFT UTILITY FUNCTIONS, POWER CONTROLLER DEVELOPMENT Final Report, May 1972 - Jul. 1974
J. D. Dudley and F. B. Moffett Sep. 1975 78 p refs
(Contract F33615-72-C-1577; AF Proj. 3145)
(AD-A015891; AFAPL-TR-75-58) Avail: NTIS CSCL 01/3

The utilization of kinetic energy stored in a high-speed flywheel for actuation of airplane utility functions required a device for converting unidirectional input rotation to selectable bidirectional output rotation. This program was initiated to develop a lightweight device for this purpose. A spring clutch concept was selected for development. Clutch engagement was accomplished at input speeds to 8686 rpm with limited output shaft inertia. Although uniform acceleration was attained, material problems encountered preclude satisfactory engagement at the desired load. Endurance relative to use in low inertia applications was not demonstrated due to these material problems. GRA

N76-18137# AiResearch Mfg. Co., Phoenix, Ariz.
ADVANCED AUXILIARY POWER UNIT Final Report, 19 May 1972 - 21 Oct. 1974
L. W. Norman, D. F. Swenski, R. C. Clarke, H. P. Gorman, and J. M. McVaugh Jul. 1975 151 p refs
(Contract F33615-72-C-1936; AF Proj. 3145)
(AD-A015893; AFAPL-TR-75-22) Avail: NTIS CSCL 10/2

The program proposed was to convert the Auxiliary Power Unit (APU) portion of the Advanced Auxiliary Power System to an all shaft power configuration, by redesigning the compressor section, but without making any changes to the turbine, combustor, or other components previously developed under the aforementioned contract. The length, diameter and approximate speed of the APU developed under the previous contract were maintained throughout the program. The performance goal was 155 net shaft horsepower output at an average turbine inlet temperature of 2000F and at ambient conditions of 130F and sea level static pressure. GRA

N76-18138# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
OPTIMAL REPLACEMENT POLICY FOR THE F-15 AIRCRAFT ENGINE MODULES M.S. Thesis
James A. Forbes and Phillip P. Wyatt Aug. 1975 194 p refs
(AD-A016266; SLSR-7-75B) Avail: NTIS CSCL 21/5

The F-100 engine, used on the F-15 aircraft, differs from previous engines in that it is modularized. Certain of the engine modules must be removed in order to perform maintenance on others. As an example, the fan module must be removed to repair the core module. If an unfailed module is removed to facilitate maintenance on another module, it may be worthwhile to replace the unfailed module rather than reinstall it. Such a replacement is termed opportunistic maintenance. The purpose of the study was to determine if an algorithm could be developed which would determine when opportunistic replacement is optimal and when it is not. An algorithm was developed and programmed in FORTRAN. Variables addressed include transportation, packing, manpower, parts, depot overhaul costs and module failure tests. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-18139*# Vizex Inc., Amherst, N.Y.
A THEORETICAL STUDY OF THE APPLICATION OF JET FLAP CIRCULATION CONTROL FOR REDUCTION OF ROTOR VIBRATORY FORCES, ADDENDUM
Andrew R. Renka Oct. 1975 88 p refs Sponsored in part by AMRDL
(Contract NAS2-7307)
(NASA-CR-137779; VIZEX-CR-74-1A) Avail: NTIS HC $5.00 CSCL 01C

The theoretical potential of a jet flap control system for reducing the vertical and horizontal non-cancelling helicopter rotor blade root shears was investigated. It was determined that the dominant contributor to the rotor power requirements is the requirement to maintain moment trim as well as force trim. It was also found that the requirement to maintain moment trim does not entail a power penalty. Author

N76-18140*# City Coll. of the City Univ. of New York.
AN ADAPTIVE LEARNING CONTROL SYSTEM FOR AIRCRAFT Status Report, 1 May 1975 - 31 Jan. 1976
Ralph Mekel and Solomon Nachmias 12 Feb. 1976 11 p refs
(Grant NsG-1169)
(NASA-CR-146283) Avail: NTIS HC $3.50 CSCL 01C

A learning control system is developed which blends the gain scheduling and adaptive control into a single learning system that has the advantages of both. An important feature of the developed learning control system is its capability to adjust the gain schedule in a prescribed manner to account for changing aircraft operating characteristics. Furthermore, if tests performed by the criteria of the learning system preclude any possible change in the gain schedule, then the overall system becomes an ordinary gain scheduling system. Examples are discussed. Author

N76-18141*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTIMALITY STUDY OF A GUST ALLEVIATION SYSTEM FOR LIGHT WING-LOADING STOL AIRCRAFT
Masaki Komoda Washington Feb. 1976 61 p refs
(NASA-TN-D-8180; A-5906) Avail: NTIS HC $4.50 CSCL 01C

An analytical study was made of an optimal gust alleviation system that employs a vertical gust sensor mounted forward of an aircraft's center of gravity. Frequency domain optimization techniques were employed to synthesize the optimal filters that process the corrective signals to the flaps and elevator actuators. Special attention was given to evaluating the effectiveness of lead time, that is, the time by which relative wind sensor information should lead the actual encounter of the gust. The resulting filter is expressed as an implicit function of the prescribed control cost. A numerical example for a light wing loading STOL aircraft is included in which the optimal trade-off between performance and control cost is systematically studied. Author

N76-18142# National Aerospace Lab., Tokyo (Japan).
HOVER CONTROL TESTS ON FLYING TEST BED FOR VTOL AIRCRAFT
Naoto Takizawa, Hirotoshi Fujieda, Koichi Ono, Yoshikazu Tanabe, Akiyoshi Shibuya, Toshio Ogawa, Tadao Kai, Yoshito Miyamoto, Tadao Torisaki, and Yoshio Oto Sep. 1975 65 p refs In JAPANESE; ENGLISH summary
(NAL-TR-425) Avail: NTIS HC $4.50

Hover control tests on the Flying Test Bed (FTB) developed to study problems associated with hovering and vertical takeoff and landing operations of VTOL aircraft were described. The tests were carried out in four steps: (1) three preliminary tests and five semi-constrained attitude control tests (roll and pitch) by remote controlled step-input, (2) twelve semi-constrained attitude control tests by two pilots (in two-and three-degree-of-freedom), (3) four tie-down tests with the crew, (4) two ground operation tests and five free flight tests by two pilots. The semi-constrained attitude tests showed good characteristics of the attitude control system including the automatic stabilization equipment of the FTB. The tie-down tests showed no adverse effects from the exhaust gas. The free flight hover control tests showed good control characteristics for force gradients, sensitivities, power, rate damping levels and overall effects on pilot feeling. Author

N76-18143# National Aerospace Lab., Tokyo (Japan).
LOADED HYDRAULIC SERVO MECHANISM SIMULATION STUDY
Mitsuei Ikeya Aug. 1975 18 p refs In JAPANESE; ENGLISH summary
(NAL-TR-421) Avail: NTIS HC $3.50

A practical simulation study of the hydraulic servo mechanism was made to facilitate synthesis of the output driving mechanisms of automatic flight control systems, flight simulators and other mechanisms. A general nonlinear mathematical model of a hydraulic servo mechanism with load was established, which was composed of a position control system. The general model was specified to particular loading conditions for practical uses, e.g. spring load, viscous load, etc. These models cleared the utility range, comparing the frequency response characteristics of calculations and experimental data. As a result, it was verified that the mathematical models could accurately describe the dynamic behavior of a hydraulic servo mechanism, with any specified loading condition, up to 10Hz. Author

N76-18144*# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
USE OF ACTIVE CONTROL SYSTEMS TO IMPROVE BENDING AND ROTOR FLAPPING RESPONSE OF A TILT ROTOR VTOL AIRPLANE
H. Philip Whitaker and Yi Cheng Oct. 1975 86 p refs
(Grant NsG-2044; OSP Proj. 82266)
(NASA-CR-137815; ASRL-TR-183-1) Avail: NTIS HC $5.00 CSCL 01C

The results are summarized of an analytical study of the use of active control systems for the purpose of reducing the root mean square response of wing vertical bending and rotor flapping to atmospheric turbulence for a tilt-rotor VTOL airplane. Only the wing/rotor assembly was considered so that results of

a wind tunnel test program would be applicable in a subsequent phase of the research. The capabilities and limitations of simple single feedback configurations were identified, and the most promising multiloop feedback configurations were then investigated. Design parameters were selected so as to minimize either wing bending or rotor flapping response. Within the constraints imposed by practical levels of feedback gains and complexity and by considerations of safety, reduction in response due to turbulence of the order of 30 to 50 percent is predicted using the rotor longitudinal cyclic and a trailing edge wing flap as control effectors. Author

N76-18145*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYTICAL STUDY OF TURBULENCE RESPONSES, INCLUDING HORIZONTAL-TAIL LOADS, OF A CONTROL-CONFIGURED VEHICLE WITH RELAXED STATIC STABILITY
Boyd Perry, III Washington Feb. 1976 63 p refs
(NASA-TN-D-8142; L-10389) Avail: NTIS HC $4.50 CSCL 01C

A static stability augmentation system (SSAS) with angle-of-attack, pitch-rate, and forward-speed feedback is used to stabilize control-configured rigid vehicles with relaxed static stability. Airplane configurations include a baseline configuration and two representative control-configured vehicle configurations. The first statically unstable configuration has baseline geometry and an aft center of gravity; the second statically unstable configuration has reduced tail length and area and a forward neutral point. Stability, flying-qualities, and maneuverability requirements are imposed on the airplane-SSAS systems. Turbulence responses of the rigid airframe and tail loads are examined in terms of configuration changes for a given control law and in terms of control law changes for a given configuration. Author

N76-18146*# Scientific Translation Service, Santa Barbara, Calif.
AIRCRAFT CONTROL SYSTEM HYDRAULIC DRIVES
V. G. Neyman Washington NASA Feb. 1976 205 p refs Transl. into ENGLISH of the book "Gidroprivody Aviatsionnykh Sistem Upravleniya" Moscow, Mashinostr. Press, 1973 p 1-200
(Contract NASw-2483)
(NASA-TT-F-799) Avail: NTIS HC $7.75 CSCL 01C

The characteristics of various test stand load simulation systems and their influence on hydraulic drive performance are discussed. Recommendations are given for selection of test stand hydraulic supply and load simulation systems which will provide the correct reproduction of the operating conditions. A technique is described for accelerated hydraulic drive service life testing, which is based on identification of weak elements and reproduction in the accelerated regime of the same degree of wear, aging, or fatigue damage accumulation of the weak elements as occurs under normal conditions. Author

N76-18147*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTIMUM DESIGN CONSIDERATIONS OF A GUST ALLEVIATOR FOR AIRCRAFT
Waldo I. Oehman Washington Mar. 1976 32 p refs
(NASA-TN-D-8152; L-10361) Avail: NTIS HC $4.00 CSCL 01C

A gust alleviation system for aircraft flying in turbulent air was analyzed. A vane sensor (with noise) was used to measure vertical gusts, and elevators and flaps were used to reduce the root-mean-square value of the normal accelerations associated with the aircraft response to gusts. Since turbulence has stochastic properties, stochastic control theory was used in the analysis. A quadratic performance-index function involving normal acceleration and control deflections was minimized. Application of the analysis was illustrated by a short take-off and landing (STOL) airplane in flight through turbulent air. Effects of varying the noise characteristics of the vane sensor and of a weighting matrix in the performance-index function were determined. Calculations were performed as required by stochastic control theory to obtain the root-mean-square response of the airplane to turbulence. Results show that good alleviation was calculated when the intensity of the measurement noise was about 3.6 percent of the vane deflection angles. Author

N76-18148# Army Aeromedical Research Lab., Fort Rucker, Ala.
BUETTNER CUEING CONCEPT FOR HELICOPTER FLIGHT CONTROL Final Report
Robert H. Wright Aug. 1975 31 p refs
(DA Proj. 3A7-62758-A-819)
(AD-A016885; USAARL-76-2) Avail: NTIS CSCL 01/3

Familiarization was obtained with a helicopter flight control cueing concept developed by a retiring senior flight instructor, with emphasis on its potential application to night vision imaging systems. It consisted of a simple set of windshield marks arranged to provide precision in contact control of pitch attitudes. Students trained with it seemed to find advanced contact and instrument training much easier than traditionally trained students, and experienced helicopter pilots introduced to the concept felt it provided substantial improvement in their control precision. Conclusions from this exploratory familiarization were that Buettner-type cue sets (a) have potential for reducing perceptual ambiguities in helicopter control with night vision devices, (b) increase precision and lead in helicopter contact control, (c) should provide a high level of transfer to instrument training, (d) with slight extension have potential as an approach aid, particularly for an underslung night vision device, and (e) appear to have potential for very simple helicopter simulator visual displays that should have considerable value for initial of transition training. Author (GRA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-18149# Parsons (Ralph M.) Co., Pasadena, Calif.
THE APRON AND TERMINAL BUILDING PLANNING MANUAL Final Report, Jan. 1974 - Jul. 1975
Jul. 1975 392 p refs
(Contract DOT-FA72WA-2950)
(AD-A018120/6; RMP-5032-2; FAA-RD-75-191) Avail: NTIS HC $10.00 CSCL 01/5

Planning recommendations are presented for terminal building areas and apron space. The apron and terminal building areas are defined as those areas included and limited by the curb roadway and associated parking on the landside and taxiway access to the apron on the airside. The principal areas presented are: apron, connector, terminal, curb roadways and parking. Space considerations are presented as they are affected by the four principal concepts and airport traffic volumes, types and station characteristics. A presentation of area and layout for all major elements of the terminal building is illustrated in tabular, graphic, and plan formats. Sources of planning information and guidance for the procurement and input of this information are provided. Gross terminal sizing recommendations for medium and long-range planning are given. Comparative costs for on and off airport projects are discussed. Author

N76-18150*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
EXPLORATORY STUDY TO INDUCE FAN NOISE IN THE TEST SECTION OF THE NASA LANGLEY FULL-SCALE WIND TUNNEL
I. L. Ver, R. E. Hayden, M. M. Myles, and B. E. Murray Dec. 1975 63 p refs
(Contract NAS1-13585)
(NASA-CR-144929; BBN-3208) Avail: NTIS HC $4.50 CSCL 14B

Measures to reduce the intensity of fan noise in the NASA Langley 30 ft x 60 ft subsonic wind tunnel were sought. Measurements were first performed to document existing aerodynamic and acoustic conditions. The purpose of these experiments was to (1) obtain the transfer function between the sound power output of the fan and the sound pressure on the

test platform, (2) evaluate the sound attenuation around the tunnel circuit, (3) measure simultaneously the flow profile and the turbulence spectrum of the inflow to the fan and the noise on the test platform, and (4) perform flow observations and identify secondary noise sources. Subsequently, these data were used to predict (1) the relative contribution of the major aerodynamic parameters to total fan noise and (2) the effect of placing a dissipative silencer in the collector duct upstream of the fan. Promising noise control measures were identified and recommendations were made on how to evaluate them. Author

N76-18151*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND ANALYSIS OF A MODULAR APPROACH TO PAYLOAD SPECIALIST TRAINING
Harry Watters and Jackie Steadman Jan. 1976 50 p refs
(NASA-TM-X-64980) Avail: NTIS HC $4.00 CSCL 14B

A modular training approach for Spacelab payload crews is described. Representative missions are defined for training requirements analysis, training hardware, and simulations. Training times are projected for each experiment of each representative flight. A parametric analysis of the various flights defines resource requirements for a modular training facility at different flight frequencies. The modular approach is believed to be more flexible, time saving, and economical than previous single high fidelity trainer concepts. Block diagrams of training programs are shown. Author

N76-18152# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DEVELOPMENT OF A STRUCTURAL DESIGN PROCEDURE FOR FLEXIBLE AIRPORT PAVEMENTS Final Report
Walter R. Barker and William N. Brabston Sep. 1975 263 p refs
(Contract DOT-FA73WAI-377)
(AD-A019205/4; FAA-RD-74-199) Avail: NTIS HC $9.00 CSCL 01/5

A design procedure is presented for three types of flexible pavement: conventional, bituminous concrete, and chemically stabilized. These represent nearly all flexible pavements being constructed at this time. Designs are based on analytically determined strain values and experimental and laboratory determined material fatigue strengths. Thus, the procedure can handle in a rational manner the possible variations in the properties of different pavement materials. An adaptation of the cumulative damage concept permits the consideration of cyclic variation in bituminous materials due to variations in temperatures and the variation in subgrade strength resulting from freeze-thaw cycles. Author

N76-18153# Avcon Universal Consultants Corp., Baden, Pa.
COMBINING DATA FOR MLS IMPLEMENTATION APPLICATIONS Final Report
T. L. Croswell Jun. 1975 53 p refs
(Contract DOT-PR-WI75-5396-1)
(AD-A018850/8; AV-MLS-75-3; FAA-RD-75-200) Avail: NTIS HC $4.50 CSCL 17/7

Data from the Aiport Master Record system are combined with data previously collected and consolidated from other sources to establish a data base of the necessary historical data to permit projection of microwave landing system (MLS) implementation for individual airports. The present status is described of instrument landing systems and other facilities such as existing runway and approach lights, obstacles, and other general and specific information describing individual airports, their runways, facilities, and operations. The data sources are briefly discussed and a sample of an application of the combined data is included. The computer programs developed are described along with source language listings of these programs, examples of input and output files, and results of applying these programs to MLS implementation. Author

N76-18154*# Washington Univ., Seattle.
REDUCTION OF WIND-TUNNEL WALL INTERFERENCE BY CONTROLLED WALL FLOW
Samuel Bernstein and Robert G. Joppa Washington NASA Mar. 1976 57 p refs
(Grant NGL-48-002-010)
(NASA-CR-2654) Avail: NTIS HC $4.50 CSCL 14B

Corrections for wind tunnel wall interferences are applied successfully to high lift models when the model to tunnel size ratio is small. The accuracy of the corrections becomes poorer when larger models are tested. An alternate method of testing was developed in which flow through the porous walls of the tunnel was actively controlled so as to approximate free air conditions in the neighborhood of the model during the test. The amount and distribution of the controlled flow through the walls is computed using a potential flow representation of the model based on the measured lift. Theoretical analysis is presented to prove the convergence of the method to free air conditions and to substantiate the general three dimensional theory of operation when the normal flow distribution is continuous. A two dimensional tunnel was constructed to evaluate the concept. Results show that substantial reduction of wall interference may be achieved with relatively low values of porosity of actively controlled walls. Author

N76-18155# National Aviation Facilities Experimental Center, Atlantic City, N.J.
VISUAL GROUND AIDS SURVEY OF JOHN F. KENNEDY INTERNATIONAL AIRPORT Interim Report, Dec. 1974 - Apr. 1975
Paul H. Jones Nov. 1975 85 p
(FAA Proj. 083-401-020)
(PB-247169/6; FAA-NA-75-38) Avail: NTIS HC $5.00 CSCL 17/7

Visual ground aids used at John F. Kennedy International Airport are surveyed. The feasibility of installing and operating an airport surface traffic control system is considered. Author

N76-18156# Federal Aviation Administration, Washington, D.C.
CHICAGO O'HARE INTERNATIONAL AIRPORT CAPACITY ANALYSIS Final Report
Carl T. Ball Nov. 1975 22 p
(AD-A018849/0; FAA-RD-75-205) Avail: NTIS HC $3.50 CSCL 01/5

A task force comprised of representatives from the FAA, airlines, and the City of Chicago was formed in December of 1974 to study the present and future capacity and delay of the Chicago O'Hare International Airport. The task force effort concentrated on two future air traffic control environments: One consisting of basic metering and spacing and wake, one consisting of basic metering and spacing and a wake vortex predictive system; the other consisting of advance metering and spacing, a discrete address beacon system, and a wake vortex predictive system. January 1975 schedule information was used to determine the present future capacity of the airport. Author

N76-18157# General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
STUDY OF MODEL AEROELASTIC CHARACTERISTICS IN THE PROPOSED HIGH REYNOLDS NUMBER TRANSONIC WIND TUNNEL (HIRT) IN REFERENCE TO THE AEROELASTIC NATURE OF THE FLIGHT VEHICLE Final Report, Apr. - Dec. 1973
R. L. Holt, G. J. Fatta, and S. P. Tyler Arnold AF Sta., Tenn. AEDC Oct. 1975 132 p refs
(Contract F40600-72-C-0015)
(AD-A016797; CASD-AFS-73-008; AEDC-TR-75-62) Avail: NTIS CSCL 14/2

A high Reynolds number transonic wind tunnel (HIRT) has been needed for some years. The proposed HIRT facility will provide such a tool. The usefulness of the HIRT facility will be largely influenced by the ability of industry to design and build wind tunnel models for an acceptable cost capable of operating within the severe environment of the tunnel. A test plan, which encompasses several critical conditions within the flight envelope, is described for two configurations. GRA

N76-18158# Calspan Corp., Buffalo, N.Y.
SELF-CORRECTING WIND TUNNELS: CONCEPT AND DEMONSTRATION (TWO REPRINTS)
W. R. Sears, R. J. Vidal, J. C. Erickson, Jr., and P. A. Catlin Oct. 1975 30 p refs Repr. from Aeron. J. (London), v. 78, no. 758/759, Feb./Mar. 1974 p 80-89 Presented at 16th Lanchestor Mem. Lecture, London, 3 May 1973 Presented at

Symp. on Wind Tunnel Design and Testing Tech., London, 6-8 Oct. 1975
(Contract N00014-72-C-0102; NR Proj. 061-199)
(AD-A016029; CALSPAN-RK-5070-A-4) Avail: NTIS CSCL 14/2

This report consists of two reprints, 'Self-Correcting Wind Tunnels' by W. R. Sears published in The Aeronautical Journal, Vol. 78, No. 758/759, February/March 1974, pp. 80-89, and 'Experiments with a Self-Correcting Wind Tunnel' by R. J. Vidal, J. C. Erickson, Jr. and P. A. Catlin presented at the 'Symposium on Wind Tunnel Design and Testing Techniques' organized by the AGARD Fluid Dynamics Panel in London on 6-8 October 1975. GRA

N76-18159# Washington Univ., Seattle. Aerospace Research Lab.
LASER HEATING FOR HIGH ENTHALPY AERODYNAMIC TEST FACILITIES Final Technical Report, 1971 - Jun. 1974
William G. Beverly, George C. Vlases, and Abraham Hertzberg Jun. 1975 32 p refs
(Contract F33615-71-C-1914; AF Proj. 7065)
(AD-A015796; ARL-75-0179) Avail: NTIS CSCL 14/2

A feasibility study has been made of the 'laser heated wind tunnel'. The analytical portion of the study indicates that it should be possible to achieve stagnation conditions of 10,000 degrees Kelvin and 1-2,000 atmosphere with laser powers of a few megawatts. Heat transfer at the throat is large, and will limit run time. An expreimental program initiated to study breakdown at high pressures, was of limited success due to state-of-the-art limitations on high power infrared window design. These limitations currently constitute the major unknown in assessing the ultimate success of the LHWT concept. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-18160*+ Alabama Univ., Huntsville. Dept. of Physics.
SPACE PROCESSING OF CRYSTALLINE MATERIALS: A STUDY OF KNOWN METHODS OF ELECTRICAL CHARACTERIZATION OF SEMICONDUCTORS: BIBLIOGRAPHY Final Technical Report
J. G. Castle Jan. 1976 39 p refs
(Contract NAS8-30774)
(NASA-CR-144187) Avail: NTIS HC $4.00 CSCL 20L

A selective bibliography is given on electrical characterization techniques for semiconductors. Emphasis is placed on noncontacting techniques for the standard electrical parameters for monitoring crystal growth in space, preferably in real time with high resolution. Author

N76-18161*# Texas Univ. at Dallas, Richardson.
A RESEARCH IN SUPPORT OF NASA'S SPACE SCIENCE Semiannual Status Report, 1 Apr. - 30 Sep. 1975
F. S. Johnson Feb. 1976 23 p refs
(Grant NGL-44-004-130)
(NASA-CR-146348) Avail: NTIS HC $3.50 CSCL 22A

An ion drift meter, extreme ultraviolet spectrometers, an extreme ultraviolet grating photometer, and a soft particle spectrometer were developed. D.M.L.

N76-18162*# National Academy of Sciences - National Research Council, Washington, D.C.
MATERIALS PROCESSING IN SPACE Practical Applications of Space Systems
1975 40 p refs
(Contract NSR-09-012-106)
(NASA-CR-146274; Paper-9) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 22C

The feasibility and possible advantages of processing materials in a nongravitational field are considered. Areas of investigation include biomedical applications, the processing of inorganic materials, and flight programs and funding. M.J.S.

N76-18163*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Institute of Technology.
THE DEEP SPACE NETWORK Progress Report, Nov. - Dec. 1975
15 Feb. 1976 169 p refs
(Contract NAS7-100)
(NASA-CR-146293; JPL-PR-42-31) Avail: NTIS HC $6.75 CSCL 22D

Deep space network progress in flight support tracking and data acquisition research and technology is reported. For individual titles, see N76-18164 through N76-18181.

N76-18164* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPATIBILITY TEST SYSTEM FOR USE WITH THE MARK 3 DSN DATA SUBSYSTEMS IMPLEMENTATION c17
A. I. Bryan and G. H. Winn *In its* The Deep Space Network 15 Feb. 1976 p 5-8 (For availability see N76-18163 09-12)
CSCL 17B

The compatibility test system is described that will be used to perform telecommunications compatibility tests with the Mariner Jupiter-Saturn 1977 and the Pioneer Venus 1978 spacecraft. The functional design of the new system utilizes capabilities provided by a compatibility test assembly and the Mark III DSN Data Subsystems (MDS) configuration. A discussion of the compatibility test system implementation identifies the special purpose equipment which comprises the compatibility test assembly. Author

N76-18165* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT c14
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Feb. 1976 p 9-10 (For availability see N76-18163 09-12)
CSCL 22D

DSN activity in support of Viking 1 and 2 cruise operations is reported, together with the implementation and new training directed toward completing the planetary configuration of the DSN for Viking support. Author

N76-18166* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT c14
R. B. Miller *In its* The Deep Space Network 15 Feb. 1976 p 11-14 (For availability see N76-18163 09-12)
CSCL 22D

The differential long baseline interferometry experiment for the purpose of measuring the wind velocities in the atmosphere of Venus as a part of the Pioneer Venus 1978 multiprobe mission is described. Author

N76-18167* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT c14
P. S. Goodwin, W. G. Meeks, R. E. Morris, and S. E. Reed *In its* The Deep Space Network 15 Feb. 1976 p 15-20 refs (For availability see N76-18163 09-12)
CSCL 22D

Having observed its first year anniversary in orbit about the sun, the Helios-1 spacecraft has performed satisfactorily. During its first year, valuable scientific data were obtained about the sun and the solar system. As Helios 1 enters its second year of successful operation, preparations for the launch of Helios B are in their final stage. Author

N76-18168* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERY LONG BASELINE INTERFEROMETRY COVARIANCE c14
J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 21-29 refs (For availability see N76-18163 09-12)
CSCL 22D

A covariance calculation is reported for determination of DSN station location and clock parameters using very long baseline interferometry (VLBI) observation of quasars. Errors of observation are assumed to arise from random (thermal) noise at the receiving antenna, and from errors in modeling the tropospheric delay. The critical error source is seen to be the troposphere. If errors in troposphere modeling are uncorrelated between observations, then 30-50 cm station location determinations can be obtained with current modeling accuracies; if, however, these errors are correlated, then a factor-of-ten improvement in

prediction of the tropospheric delay is needed to achieve this accuracy range. Author

N76-18169* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BINARY SEQUENTIAL RANGING WITH SINE WAVES **c17**
W. L. Martin and J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 30-36 refs (For availability see N76-18163 09-12)
CSCL 22D

Current ranging systems of the deep space network estimate the range to a spacecraft by measuring the phase of a square wave range code after its roundtrip from station to spacecraft and back. Distortion of this waveform, in the form of phase shifts of the harmonics of the square wave, can seriously degrade ranging accuracy. It is shown that such degradation can be largely eliminated by zonal filtering the range code to only its sine wave fundamental at no net cost in ranging signal power or accuracy. Author

N76-18170* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPATH TESTS ON 64-m ANTENNAS USING THE VIKING ORBITER-1 AND -2 SPACECRAFT AS FAR-FIELD ILLUMINATORS **c17**
T. Y. Otoshi and D. L. Brunn *In its* The Deep Space Network 15 Feb. 1976 p 41-49 refs (For availability see N76-18163 09-12)
CSCL 17B

Far field multipath tests were performed on the 64-m antennas at Goldstone, DSS 14, and Madrid, DSS 63, by use of the transponders on the Viking Orbiter-1 and -2 spacecrafts. At the time of the tests, Viking Orbiter-1 and -2 spacecrafts were in their interplanetary orbits to Mars and were respectively about 21.9 million and 13.9 million km from Earth. The test results showed that the effects of multipath in the far field of the 64-m antenna were to cause less than a 5-ns peak-to-peak variation on two way range and 0.1-db peak-to-peak variations on received signal level. The multipath signal level was calculated to be approximately 40 db weaker than the primary signal in the far field main beam direction. Author

N76-18171* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A SUPERCONDUCTING CAVITY STABILIZED MASER OSCILLATOR **c36**
W. Higa *In its* The Deep Space Network 15 Feb. 1976 p 50-53 refs (For availability see N76-18163 09-12)
CSCL 20E

The possibility of using a superconducting cavity to stabilize a microwave oscillator is elaborated. The achievement of cavity Qs of the order of 10 to the 10th power has made possible the realization of frequency standards with performance which could surpass that of the hydrogen maser. The present study explores the possibility of integrating a superconducting cavity with a traveling wave maser to obtain a frequency standard with very high spectral purity. Author

N76-18172* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QVLBI DOPPLER DEMONSTRATIONS CONDUCTED DURING PIONEER 2 ENCOUNTER AND SOLAR CONJUNCTIONS **c13**
C. C. Chao *In its* The Deep Space Network 15 Feb. 1976 p 54-66 refs (For availability see N76-18163 09-12)
CSCL 22C

During the Jupiter encounter of Pioneer 11 in December 1974, a limited amount of simultaneous two way and three way Doppler was obtained. It was demonstrated that, based on a very short arc of u[illegible]nced Doppler (quasi very long baseline interferometry or QVLBI Doppler), the B-plane predictions were as good as 200 km at E-1 day and 400 km at E-3 days. During the two solar conjunctions of Pioneer 10 and 11, which occurred in March 1975, several passes of QVLBI Doppler were obtained and analyzed. The data quality of QVLBI Doppler was found to be two to three times better than the conventional two way Doppler when the sun-earth-probe angle was less than 5 degrees. Author

N76-18173* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THRESHOLD ANALYSIS FOR VLBI DELAY AND DOPPLER **c17**
J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 67-74 refs (For availability see N76-18163 09-12)
CSCL 22C

The problem of estimating delay difference and Doppler frequency difference is considered for the arrival of a white noise signal from a distant quasar at two widely separated receiving stations on earth. The nonlinear Barankin bound is reviewed as it applies to the very long baseline interferometry (VLBI) problem, and used to evaluate the signal-to-noise ratio threshold for VLBI estimates. The performance of several sampling strategies for VLBI data is compared. Author

N76-18174* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF COMMAND DETECTOR SIGNAL-TO-NOISE RATIO ESTIMATOR **c17**
R. G. Lipes *In its* The Deep Space Network 15 Feb. 1976 p 75-83 refs (For availability see N76-18163 09-12)
CSCL 17B

A specific technique is reported for making (SNR) square root estimates by using in-phase channel output averages to estimate signal and quadrature channel output averages to estimate noise. Bounds are produced to determine the accuracy of this technique when fluctuations of one standard deviation occur. Results show the estimate is relatively independent of actual input signal-to-noise ratio (SNR) and can be improved only by increasing the number of samples in the averages. Author

N76-18175* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER HIGH-VOLTAGE POWER SUPPLY RIPPLE **c33**
E. J. Finnegan *In its* The Deep Space Network 15 Feb. 1976 p 84-87 (For availability see N76-18163 09-12)
CSCL 09C

The results of decreasing the high voltage power supply ripple by redesigning the low pass filter are reported. Author

N76-18176* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VENUS STATION AUTOMATION: COMMUNICATIONS LINK **c17**
A. Zygielbaum *In its* The Deep Space Network 15 Feb. 1976 p 88-95 refs (For availability see N76-18163 09-12)
CSCL 17B

A highly error resistant communications system has been developed in support of the demonstration of the remote automatic control of the Venus station (DSS 13). The computer communications software used to connect the JPL control terminal to the Venus station is described, and the software used to drive the teletype line which is part of the link is detailed. Author

N76-18177* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF WIDEBAND DIGITAL RECORDING EQUIPMENT IN THE DSN **c35**
K. R. Kimball *In its* The Deep Space Network 15 Feb. 1976 p 96-104 (For availability see N76-18163 09-12)
CSCL 14B

The DSN is implementing wideband digital recording equipment for mission support in the 1978 to 1981 time era. This article describes the development status of this equipment and the factors which were of major importance in the design approach. Design of equipment is discussed to the functional block diagram level. Author

N76-18178* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND-X-BAND DIRECTIONAL COUPLER **c17**
R. Lay *In its* The Deep Space Network 15 Feb. 1976 p 105-107 refs (For availability see N76-18163 09-12)
CSCL 17B

In support of an effort to reduce microwave noise bursts at the DSN tracking stations, an S-band-X-band directional coupler has been fabricated. The goal was to develop a directional coupler that has a coupling of about 30 db using two different rectangular waveguide sizes. Author

N76-18179* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HEAT TRANSFER CRITERIA OF A TUBULAR SOLAR COLLECTOR: THE EFFECT OF REVERSING THE FLOW

PATTERN ON COLLECTOR PERFORMANCE **c34**
F. L. Lansing *In its* The Deep Space Network 15 Feb. 1976 p 108-114 refs (For availability see N76-18163 09-12)
CSCL 20D

A new evacuated tubular solar collector has been selected for further investigation for the application of Goldstone energy conservation projects. The exact heat transfer analysis of this two-pass-flow collector is reported in an effort to determine the difference in performance characteristics with two different flow patterns. The results from this analysis are not only the determination of the collected heat rate and the temperature profiles at each cross section but also the prediction of the maximum attainable fluid temperature at zero flow rate in both cases. Author

N76-18180* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE VIKING 2 LAUNCH PHASE **c17**
J. A. Wackley *In its* The Deep Space Network 15 Feb. 1976 p 115-127 ref (For availability see N76-18163 09-12)
CSCL 22D

Viking 2 launch phase operational procedures, and in particular the DSN initial acquisition procedures, were very intensively considered and conservatively designed to accommodate even the most unfavorable of launch possibilities. These procedures were successfully implemented and strongly contributed to the highly successful launch of Viking 2. Author

N76-18181* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENT IN DYNAMIC MODELING FOR A COMPLETE SOLAR-POWERED ENERGY SYSTEM **c44**
C. L. Hamilton *In its* The Deep Space Network 15 Feb. 1976 p 137-143 refs (For availability see N76-18163 09-12)
CSCL 10A

Completion of a prototype dynamic model simulating the performance of a solar powered energy system is described. A set of hypothetical components is specified, and the outcome of test analyses of the resulting system is outlined. On the basis of this exercise, it appears that the dynamic modeling technique will constitute a useful and convenient tool for analyzing performance of time-dependent systems. Author

N76-18182*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
SOLIDIFICATION UNDER ZERO GRAVITY: A LONG DURATION EXPOSURE FACILITY (LDEF) EXPERIMENT FOR AN EARLY SPACE SHUTTLE MISSION Semiannual Report
John A. Bailey and John K. Whitfield [1976] 28 p
(Grant NsG-1136)
(NASA-CR-146338) Avail: NTIS HC $4.00 CSCL 11G

The preliminary design of two series of simple experiments the objectives of which are to determine the effect of an absence of gravity on (1) the general morphology of the structure, (2) location of ullage space, and (3) magnitude of surface tension driven convection, during the solidification of several metallic and nonmetallic systems is described. Details of the investigative approach, experimental procedure, experimental hardware, data reduction and analysis, and anticipated results are given. Author

N76-18183*# United Technologies Research Center, East Hartford, Conn.
PROCESSING EUTECTICS IN SPACE Summary Report
F. C. Douglas and S. F. Galasso Nov. 1975 72 p refs
(Contract NAS8-29669)
(NASA-CR-144196; R75-911721-10) Avail: NTIS HC $4.50 CSCL 13H

The investigations of directional solidification have indicated the necessity of establishing a secure foundation in earth-based laboratory processing in order to properly assess low-gravity processing. Emphasis was placed on evaluating the regularity of microstructure of the rod-like eutectic Al-Al3Ni obtained under different conditions of growth involving the parameters of thermal gradient, solidification rate, and interfacial curvature. In the case of Al-Al3Ni, where the Al3Ni phase appears as facets rods, solidification rate was determined to be a controlling parameter. Zone melting of thin eutectic films showed that for films of the order of 10 to 20 micrometers thick, the extra surface energy appears to act to stabilize a regular microstructure. The results suggest that the role of low-gravity as provided in space-laboratory processing of materials is to be sought in the possibility of generating a higher thermal gradient in the solidifying ingot for a given power input-output arrangement than can be obtained under normal one-g processes. Author

N76-18184*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: DETECTION AND MINIMIZATION OF IGNITION HAZARDS FROM WATER/GLYCOL CONTAMINATION OF SILVER-CLAD ELECTRICAL CIRCUITRY
W. Richard Downs Washington Mar. 1976 19 p ref
(NASA-TN-D-8177; JSC-S-449) Avail: NTIS HC $3.50 CSCL 09C

The potential flammability hazard when a water/glycol solution contacts defectively insulated silver-clad copper circuitry or electrical components carrying a direct current is described. The chemical reactions and means for detecting them are explained. Methods for detecting and cleaning contaminated areas and the use of inhibitors to arrest chemical reactivity are also explained. Preventive measures to minimize hazards are given. Photomicrographs of the chemical reactions occurring on silver clad wires are also included. Author

N76-18185*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESULTS OF SKYLAB EXPERIMENT T00-2, MANUAL NAVIGATION SIGHTINGS
Robert J. Randle Washington Feb. 1976 24 p refs
(NASA-TN-D-8141; A-6207) Avail: NTIS HC $3.50 CSCL 22A

An analysis of navigation data collected using a hand-held space sextant on the second and third manned Skylab missions was presented. From performance data and astronaut comments it was determined that: (1) the space sextant, the sighting station, and the sighting techniques require modification; (2) the sighting window must be of good optical quality; (3) astronaut performance was stable over long mission time; and (4) sightings made with a hand-held sextant were accurate and precise enough for reliable interplanetary manual navigation. Author

N76-18186*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CREW STATION INTEGRATION. VOLUME 1: CREW STATION DESIGN AND DEVELOPMENT
Louis D. Allen and Dale A. Nussman Washington Mar. 1976 72 p
(NASA-TN-D-8178; JSC-S-451-Vol-1) Avail: NTIS HC $4.50 CSCL 22C

An overview of the evolution of the design and development of the Apollo command module and lunar module crew stations is given, with emphasis placed on the period from 1964 to 1969. The organizational planning, engineering techniques, and documentation involved are described, and a detailed chronology of the meetings, reviews, and exercises is presented. Crew station anomalies for the Apollo 7 to 11 missions are discussed, and recommendations for the solution of recurring problems of crew station acoustics, instrument glass failure, and caution and warning system performance are presented. Photographs of the various crew station configurations are also provided. Author

N76-18187*# Colorado Univ., Boulder.
SOLUTION OF THE EXACT EQUATIONS FOR THREE-DIMENSIONAL ATMOSPHERIC ENTRY USING DIRECTLY MATCHED ASYMPTOTIC EXPANSIONS Final Report
Adolf Busemann, Nguyen X. Vinh, and Robert D. Culp Washington NASA Mar. 1976 35 p refs
(Grant NsG-1056)
(NASA-CR-2643) Avail: NTIS HC $4.00 CSCL 22C

The problem of determining the trajectories, partially or wholly contained in the atmosphere of a spherical, nonrotating planet, is considered. The exact equations of motion for three-dimensional, aerodynamically affected flight are derived. Modified Chapman variables are introduced and the equations are transformed into a set suitable for analytic integration using asymptotic expansions. The trajectory is solved in two regions: the outer region, where

the force may be considered a gravitational field with aerodynamic perturbations, and the inner region, where the force is predominantly aerodynamic, with gravity as a perturbation. The two solutions are matched directly. A composite solution, valid everywhere, is constructed by additive composition. This approach of directly matched asymptotic expansions applied to the exact equations of motion couched in terms of modified Chapman variables yields an analytical solution which should prove to be a powerful tool for aerodynamic orbit calculations. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-18188*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
PINES NONSINGULAR GRAVITATIONAL POTENTIAL DERIVATION, DESCRIPTION AND IMPLEMENTATION
Jose L. Spencer 9 Feb. 1976 54 p refs
(Contract NAS9-13970)
(NASA-CR-147478; MDC-W0013) Avail: NTIS HC $4.50 CSCL 22A

An engineering interpretation of and some minor corrections to previously completed work on a uniform representation of the gravitational potential and its derivatives (with emphasis on avoiding the usual singularity at the pole) were presented. The physical meaning of the variables was explained, the derivation of results was separated into smaller parts for easier reading, some additional recurrence relations for the derived Legendre polynomials were included and compared, and a computer program implementing this formulation was presented. Numerical experiments have shown that the use of this representation, besides removing the singularity, substantially increases the speed of the computation. Author

N76-18189*# TRW, Inc., Redondo Beach, Calif. Defense and Space Systems Group.
A SUGGESTED CLASSIFICATION SYSTEM FOR STANDARD ON-ORBIT SHUTTLE FLIGHT PHASES
S. W. Wilson 26 Jan. 1976 27 p refs
(Contract NAS9-14723)
(NASA-CR-147485; TRW-28415-H001-RO-00) Avail: NTIS HC $4.00 CSCL 22A

The definition of standard flight segments of phases, representing flight profile components which can be combined in various sequences to satisfy particular objectives, is a necessity for simplifying operational procedures and for minimizing the cost of flight planning, software development, and training. The critical elements are (1) a greater variety of generic segment types that may be incorporated into a given flight profile, (2) a greater variability of the order in which segments may be combined to construct a particular flight profile, and (3) a greater variation of detail within a given generic segment type. All of these variations arise basically from shuttle payload characteristics. They are manifested in a number of ways, including changes in the shuttle configuration from one flight to another. Author

N76-18190*# Martin Marietta Corp., Denver, Colo.
MARS SURFACE SAMPLE RETURN TRADEOFF STUDIES Final Report
Oct. 1975 106 p refs Prepared for JPL
(Contracts NAS7-100)
(NASA-CR-146439; MCR-75-391) Avail: NTIS HC $5.50 CSCL 22A

Results of tradeoff studies concerning the Mars Surface Sample Return (MSSR) mission are presented. Factors considered include: Mars mission opportunities in the 1980-1990 time frame; design features of the hardware systems used to return the sample; minimization of probability of back contamination; direct entry of the returning sample capsule at earth vs. orbital capture of the capsule for recovery by the shuttle; and possibility of increasing the landed weight at Mars to support MSSR mission modes involving heavier systems. Author

N76-18191*# Joint Publications Research Service, Arlington, Va.
COSMONAUT POPOVICH ON THE SOYUZ-17 - SALYUT-4 EXPERIMENTS
A. Romanov Washington NASA Mar. 1976 5 p Transl. into ENGLISH from Sov. Estoniya (Tallinn), 12 Feb. 1975 p 3 (NASA Order W-13183)
(NASA-TT-F-16906) Avail: NTIS HC $3.50 CSCL 22C

Salyut-3 cosmonaut P. Popovich reviews the Soyuz-17 - Salyut-4 flight. The astrophysical and terrestrial observation experiments are listed with X-ray and solar telescopes and a spectrometer. Electroacoustic measurement of bone tissue density EKG examinations and vestibular reaction tests were carried out using a rotating chair. An automatic navigation system was tested. The system, the 'Del'ta,' operates with an onboard computer which can make navigational calculations without ground control aid. Author

N76-18192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY DISCUSSION OF GRAVITATIONAL PHYSICS EXPERIMENTS FOR THE SPACELAB ERA
Rudolf Decher and Carl G. Winkler 5 Feb. 1976 35 p refs
(NASA-TM-X-64982) Avail: NTIS HC $4.00 CSCL 22A

An overview of past, present, and proposed future experiments in gravitational physics is given. These experiments are concerned with the measurement of relativistic gravity effects to test theories of gravitation. Certain experiments which could be performed on shuttle and Spacelab missions and the potential of Spacelab for gravitation physics research are discussed. Author

N76-18193*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF SPACECRAFT FLIGHT DYNAMICS
Yu. K. Khodarev, L. N. Shatrovskiy, ed., and P. Ye. Elyasberg, ed. Washington NASA Feb. 1976 200 p refs Transl. into ENGLISH of the mono. "Issledovaniya po Dinamike Poleta Kosmicheskikh Apparatov" Moscow, Nauka Press, 1973 p 1-141
(Contract NASw-2483)
(NASA-TT-F-778) Avail: NTIS HC $7.50 CSCL 22A

Spacecraft flight dynamics problems are examined and new algorithms for their solution are proposed. The problems of increasing the accuracy of spacecraft motion determination from measurement data are investigated. An algorithm for controlling the aerodynamic descent of a circular orbit is analyzed. New approaches to the solution of some optimization problems are presented. Author

N76-18194*# National Aeronautics and Space Administration, Washington, D.C.
OUTSTANDING SUCCESS OF SOVIET COSMONAUTICS
V. Avduyevskiy, V. Ishevskiy, M. Marov, and V. Moroz Mar. 1976 10 p Transl. into ENGLISH from Pravda (Moscow), No. 52 (21021), 21 Feb. 1976 p 3-4
(NASA-TT-F-16934) Avail: NTIS HC $3.50 CSCL 22C

The descent vehicles Venera 9 and Venera 10 are briefly described including their instrumentation and operational performance. Pictures of Venus' surface transmitted to earth are discussed along with other transmitted data. J.M.S.

N76-18172* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QVLBI DOPPLER DEMONSTRATIONS CONDUCTED DURING PIONEER 2 ENCOUNTER AND SOLAR CONJUNCTIONS
C. C. Chao *In its* The Deep Space Network 15 Feb. 1976 p 54-66 refs (For availability see N76-18163 09-12)
CSCL 22C

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-18195*# National Academy of Sciences - National Research Council, Washington, D.C.
INSTITUTIONAL ARRANGEMENTS Practical Applications of Space Systems
1975 56 p refs
(Contract NSR-09-012-106)
(NASA-CR-146275; Paper-10) Avail: NTIS HC $4.50; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 14B

The practical application of space systems is considered in terms of institutional arrangements. The evolution of space systems is examined along with examples of institutional arrangements for space systems uses or applications. An institutional framework developed to assure the widest practicable application of space system is proposed and described. Recommendations are included. J.M.S.

N76-18196*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SITE EVALUATION FOR LASER SATELLITE-TRACKING STATIONS
N. H. Mao and P. A. Mohr 6 Feb. 1976 131 p refs
(Grant NGR-09-015-002)
(NASA-CR-146427; SAO-Special-Rept-371) Avail: NTIS HC $6.00 CSCL 14B

Twenty-six locations for potential laser satellite-tracking stations, four of them actually already occupied in this role, are reviewed in terms of their known local and regional geology and geophysics. The sites are also considered briefly in terms of weather and operational factors. Fifteen of the sites qualify as suitable for a stable station whose motions are likely to reflect only gross plate motion. The others, including two of the present laser station sites (Arequipa and Athens), fail to qualify unless extra monitoring schemes can be included, such as precise geodetic surveying of ground deformation. Author

N76-18165* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. J. Mudgway and D. W. Johnston *In its* The Deep Space Network 15 Feb. 1976 p 9-10 (For availability see N76-18163 09-12)
CSCL 22D

N76-18166* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER VENUS 1978 MISSION SUPPORT
R. B. Miller *In its* The Deep Space Network 15 Feb. 1976 p 11-14 (For availability see N76-18163 09-12)
CSCL 22D

N76-18167* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin, W. G. Meeks, R. E. Morris, and S. E. Reed *In its* The Deep Space Network 15 Feb. 1976 p 15-20 refs (For availability see N76-18163 09-12)
CSCL 22D

N76-18168* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERY LONG BASELINE INTERFEROMETRY COVARIANCE
J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 21-29 refs (For availability see N76-18163 09-12)
CSCL 22D

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-18197# Royal Aircraft Establishment, Farnborough (England).
STATE OF DEVELOPMENT AND APPLICATION OF CATALYTIC AND ELECTROTHERMAL HYDRAZINE PROPULSION UNITS FOR TRAJECTORY AND ATTITUDE CONTROL OF SATELLITES
H. D. Schmitz Nov. 1975 21 p Transl. into ENGLISH from the German report
(RAE-LIB-Trans-1865; BR50362) Avail: NTIS HC $3.50

Developments in European low thrust hydrazine propulsion are reviewed and the intramural activities of ERNO in this field are briefly presented. Author

N76-18198# Hughes Research Labs., Malibu, Calif.
HYDROGEN MASER FREQUENCY STANDARD SYSTEMS Final Technical Report, 19 May - 19 Sep. 1975
A. Popa, A. Chester, W. Bridges, J. Etter, and H. Wang Sep. 1975 148 p refs
(Contract N00014-75-C-1149)
(AD-A016284) Avail: NTIS CSCL 17/7

Space-qualified hydrogen maser atomic clocks suitable for the Global Positioning System (GPS) are reviewed in this study. Existing ground-based masers are compared in performance and failure modes. Design improvements are suggested for the components of both the physics unit and the electronics unit of a space qualifiable maser clock. Several overall design options including passive operation are compared in projected performance. Reliability and accelerated life testing procedures are discussed. A schedule for the orderly development of masers for the GPS is given. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N76-18199*# National Academy of Sciences - National Research Council, Washington, D.C.
SPACE TRANSPORTATION Practical Applications of Space Systems
1975 40 p refs
(Contract NSR-09-012-106)
(NASA-CR-146277; Paper-12) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 22C

User-oriented panels were formed to examine practical applications of information or services derived from earth orbiting satellites. Topics discussed include: weather and climate; uses of communication; land use planning; agriculture, forest, and range; inland water resources; retractable resources; environmental quality; marine and maritime uses; and materials processing in space. Emphasis was placed on the interface of the space transportation system (STS) with the applications envisioned by the user panels. User requirements were compared with expected STS capabilities in terms of availability, carrying payload to orbit, and estimated costs per launch. Conclusions and recommendations were reported. J.M.S.

N76-18200*# Boeing Aerospace Co., Seattle, Wash.
FUTURE SPACE TRANSPORTATION SYSTEMS ANALYSIS STUDY. PHASE 1 EXTENSION: TRANSPORTATION SYSTEMS REFERENCE DATA, VOLUME 2
19 Dec. 1975 246 p
(Contract NAS9-14323)
(NASA-CR-147481; D180-19201-2-Vol-2) Avail: NTIS HC $8.00 CSCL 22A

Transportation mass requirements are developed for various mission and transportation modes based on vehicle systems sized to fit the exact needs of each mission. The parametric data used to derive the mass requirements for each mission and transportation mode are presented to enable accommodation of possible changes in mode options or payload definitions. The vehicle sizing and functional requirements used to derive the parametric data are described. Author

N76-18201*# Boeing Aerospace Co., Seattle, Wash.
FUTURE SPACE TRANSPORTATION SYSTEMS ANALYSIS STUDY. PHASE 1 EXTENSION: EXECUTIVE SUMMARY
19 Dec. 1975 43 p
(Contract NAS9-14323)
(NASA-CR-147482; D180-19201-3) Avail: NTIS HC $4.00 CSCL 22A

Potential future space programs are analyzed beyond the scope of the current shuttle traffic model to determine their transportation needs and alternative ways of evolving future space transportation systems from the baseline space transportation system (space shuttle and upper stage). Objectives of the entire study are summarized along with results to date. Author

N76-18202*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ATMOSPHERIC SCIENCE FACILITY PALLET-ONLY MODE SPACE TRANSPORTATION SYSTEM PAYLOAD (FEASIBILITY STUDY), VOLUME 2 Interim Technical Report
Nov. 1975 150 p refs
(NASA-TM-X-72957; JSC-10683-Vol-2-Rev-A) Avail: NTIS HC $6.00 CSCL 22B

For abstract, see N00-00BAD.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N76-18203*# Raytheon Co., Sudbury, Mass. Equipment Development Lab.
SPACE VEHICLE ONBOARD COMMAND ENCODER Final Report
17 Dec. 1975 271 p
(Contract NAS9-14372)
(NASA-CR-147459; ER-75-4458) Avail: NTIS HC $9.00 CSCL 17B

A flexible onboard encoder system was designed for the space shuttle. The following areas were covered: (1) implementation of the encoder design into hardware to demonstrate the various encoding algorithms/code formats, (2) modulation techniques in a single hardware package to maintain comparable reliability and link integrity of the existing link systems and to integrate the various techniques into a single design using current technology. The primary function of the command encoder is to accept input commands, generated either locally onboard the space shuttle or remotely from the ground, format and encode the commands in accordance with the payload input requirements and appropriately modulate a subcarrier for transmission by the baseband RF modulator. The following information was provided: command encoder system design, brassboard hardware design, test set hardware and system packaging, and software. Author

N76-18204*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIOCOMMUNICATIONS FOR METEOROLOGICAL SATELLITE SYSTEMS
Barbara A. Walton Aug. 1975 70 p refs Supersedes X-120-73388
(NASA-TM-X-71056; X-901-75-191; X-120-73-388) Avail: NTIS HC $4.50 CSCL 17B

A general overview is presented of the spectrum utilization and frequency requirements of present and planned meteorological satellite programs. The sensors, and TIROS operational systems are discussed along with the Nimbus and Synchronous Meteorological Satellites. STORMSAT, SEASAT, and the Spacelab are briefly described. F.O.S.

N76-18205*# Lockheed Electronics Co., Houston, Tex.
FREQUENCY MODULATION SYSTEM TEST PROCEDURE SHUTTLE TASK 501 APPROACH AND LANDING TEST CONFIGURATION
G. D. Doland Jan. 1976 76 p
(Contract NAS9-12200)
(NASA-CR-147467; JSC-10866; LEC-7500) Avail: NTIS HC $5.00 CSCL 17B

Shuttle Task 501 is an in-line task to test the performance and compatibility of radiofrequency links between the SSO and ground, and relay via a satellite. Under Shuttle Task 501 approach and landing test (ALT) phase only a limited portion of the communication and tracking (C&T) equipment is to be tested. The principal item to be tested is a frequency modulated (FM) data link. To test this RF link, an ALT FM System was designed, constructed, and the console wiring verified. A step-by-step procedure to be used to perform the ALT FM system is presented. The ALT FM system test is to be performed prior to delivery of the equipment to the Electronic Systems Test Laboratory (ESTL). Author

N76-18206# Institute for Telecommunication Sciences, Boulder, Colo.
ON BANDWIDTH LIMITATIONS AT 15 TO 45 GHz FOR A SATELLITE/GROUND LINK
H. T. Dougherty, E. J. Dutton, and M. T. Ma Aug. 1975 48 p refs
(COM-75-11392/8; OTR-75-71) Avail: NTIS HC $4.00 CSCL 17B

A simple transmission channel transfer function is derived, including the effects of attenuation and phase delays caused by atmospheric gases and spherical raindrops. Based on this transfer function, a formula is obtained to estimate the probability of error in a quadri-phase-keyed (QPSK) system. In addition, an assessment is made of the impact of nonspherical raindrops, in the 15 to 45 GHz frequency region, on both the enhanced attenuation and cross-polarization discrimination for a system using dual linear or orthogonal circular polarizations. GRA

N76-18207# Range Commanders Council, White Sands Missile Range, N.Mex. Inter-Range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS
Jul. 1975 397 p Supersedes AD-782699
(AD-A016052; IRIG-118-73-Rev; AD-782699) Avail: NTIS CSCL 09/6

The document defines standard test methods for telemetry ground systems and related subsystems. Use of the methods as described in this document will enable the exchange of test results which are derived and expressed in a common manner. In addition, the performance characteristics will be a valuable aid in preventive maintenance and readiness evaluation. It is recommended that these methods be used as standards for determining telemetry system performance. GRA

N76-18208# RDP, Inc., Bedford, Mass.
DIGITAL FILTERING ANALYSIS APPLIED TO THE ATMOSPHERE EXPLORER-C SATELLITE MESA ACCELEROMETER DATA Interim Report
Joseph P. Noonan, Robert W. Fioretti, and Barry Hass 15 Feb. 1975 43 p refs
(Contract F19628-73-C-0142)
(AD-A015765; AFCRL-TR-75-0293; SR-1) Avail: NTIS CSCL 09/4

This report summarizes the mathematical and data analyses required to extract scientifically meaningful data from a total output signal degraded by noise. The methods described use digital filtering techniques, and the results are applied specifically to scientific accelerometer data flown aboard the Atmosphere Explorer satellite. Atmospheric drag and density variations are calculated using these methods. The results given will be

incorporated by analysts and experimenters into presentations given at scientific meetings. GRA

N76-18164* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPATIBILITY TEST SYSTEM FOR USE WITH THE MARK 3 DSN DATA SUBSYSTEMS IMPLEMENTATION
A. I. Bryan and G. H. Winn *In its* The Deep Space Network 15 Feb. 1976 p 5-8 (For availability see N76-18163 09-12)
CSCL 17B

N76-18169* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BINARY SEQUENTIAL RANGING WITH SINE WAVES
W. L. Martin and J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 30-36 refs (For availability see N76-18163 09-12)
CSCL 22D

N76-18170* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPATH TESTS ON 64-m ANTENNAS USING THE VIKING ORBITER-1 AND -2 SPACECRAFT AS FAR-FIELD ILLUMINATORS
T. Y. Otoshi and D. L. Brunn *In its* The Deep Space Network 15 Feb. 1976 p 41-49 refs (For availability see N76-18163 09-12)
CSCL 17B

N76-18173* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THRESHOLD ANALYSIS FOR VLBI DELAY AND DOPPLER
J. W. Layland *In its* The Deep Space Network 15 Feb. 1976 p 67-74 refs (For availability see N76-18163 09-12)
CSCL 22C

N76-18174* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALYSIS OF COMMAND DETECTOR SIGNAL-TO-NOISE RATIO ESTIMATOR
R. G. Lipes *In its* The Deep Space Network 15 Feb. 1976 p 75-83 refs (For availability see N76-18163 09-12)
CSCL 17B

N76-18176* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VENUS STATION AUTOMATION: COMMUNICATIONS LINK
A. Zygielbaum *In its* The Deep Space Network 15 Feb. 1976 p 88-95 refs (For availability see N76-18163 09-12)
CSCL 17B

N76-18178* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND-X-BAND DIRECTIONAL COUPLER
R. Lay *In its* The Deep Space Network 15 Feb. 1976 p 105-107 refs (For availability see N76-18163 09-12)
CSCL 17B

N76-18180* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING OPERATIONS DURING THE VIKING 2 LAUNCH PHASE
J. A. Wackley *In its* The Deep Space Network 15 Feb. 1976 p 115-127 ref (For availability see N76-18163 09-12)
CSCL 22D

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-18209*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
APPLICATIONS STUDY OF AERO-MANEUVERING ORBIT-TO-ORBIT SHUTTLE (AMOOS), EXECUTIVE SUMMARY
John White Jan. 1976 37 p refs
(Contract NAS8-31452)
(NASA-GR-144182; LMSC-HREC-TR-D496705) Avail: NTIS HC $4.00 CSCL 22B

Preliminary designs and the supporting analysis for both the Aeromaneuvering Orbit-to-Orbit Shuttle (AMOOS) and the Aeromaneuvering Recovery System (AMRS) are presented. The AMOOS design is shown to yield from twice to almost three times the high energy, round-trip payloads as a purely propulsive vehicle of the same weight. Typically AMOOS can perform a crew rotation mission to equatorial geosynchronous orbit in one space shuttle launch. The flight test program analysis modeled parameters such as maximum dynamic pressure, heating rates, guidance, stability and recovery. Two model flight schedules were developed, one consisting of four flights and the other of two flights. The former is considered a very low risk, high information return program whereas the latter is a minimal cost program consistent with reasonable data returns and chance of success. The AMOOS and AMRS guidance scheme developed using linear regulator theory proved a precise and accurate guidance scheme. Both it and a classical linear system's based scheme were evaluated using 65 simulated trajectories in which the position in the entry corridor and the atmospheric density were varied randomly. Author

N76-18210*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
APPLICATIONS STUDY OF AERO-MANEUVERING ORBIT-TO-ORBIT SHUTTLE (AMOOS) Final Report
John White Jan. 1976 224 p refs
(Contract NAS8-31452)
(NASA-CR-144183; LMSC-HREC-TR-D496644) Avail: NTIS HC $7.75 CSCL 22B
For abstract, see N76-18209.

N76-18211*# Rockwell International Corp., El Segundo, Calif. Space Div.
USE OF STS SUBSYSTEMS AND COMPONENTS FOR MMSE, VOLUME 1 Executive Summary
Dec. 1975 25 p 2 Vol.
(Contract NAS9-14598)
(NASA-CR-147476; SD-75-SA-0181-Vol-1) Avail: NTIS HC $3.50 CSCL 22B

Multiuse mission support equipment (MMSE) is flight/ground equipment for the shuttle era which is used in conjunction with more than one mission payload. Initial verification of STS subsystem's applicability to MMSE is provided along with the cost savings potential and programmatic data needed for further program planning decisions. Some 70 MMSE requirements were found to be potentially satisfied by STS equipment, and and 6 items of particular interest were chosen for special emphasis. All were found to be feasible and beneficial. Program cost savings through their use are estimated to be substantial. Further study is recommended to identify additional MMSE requirements and hardware. Author

N76-18212*# Rockwell International Corp., El Segundo, Calif. Space Div.
USE OF STS SUBSYSTEMS AND COMPONENTS FOR MMSE, VOLUME 2 Final Technical Report
Dec. 1975 241 p refs 2 Vol.
(Contract NAS9-14598)
(NASA-CR-147477; SD-75-SA-0181-Vol-2) Avail: NTIS HC $8.00 CSCL 22B
For abstract, see N76-18211.

N76-18213*# Sperry Flight Systems, Phoenix, Ariz.
AN EVALUATION OF REACTION WHEEL EMITTED VIBRATIONS FOR LARGE SPACE TELESCOPE Final Report
Jan. 1976 219 p refs
(Contract NAS8-31037)
(NASA-CR-144190; Publ-71-0824-00-00) Avail: NTIS HC $8.00 CSCL 22B

Emitted force and torque vibration were measured in three axes for three Sperry reaction wheels. Data were taken for both hard and soft mounts; tests were conducted at constant speeds and during runup-rundown over a 0 to 5000 rpm range. A FSC, 7 ft-lb-sec and HEAO, 30 ft-lb-sec ball bearing reaction wheel and a model magnetic bearing were tested. Data analysis was conducted to identify the principal resonances in the 10 to

120 Hz region. Although some particular phenomena remain unexplained, in general good agreement is attained between the analytical predictions and test data. Predictions were also made of the expected emitted vibrations for an LST sized ball bearing and magnetic bearing reaction wheel using engineering judgment and the test data obtained. Additional tests were also run on the 101H duplex bearing pairs used in the reaction wheel suspension to determine bearing stiffness characteristics in the pre-breakaway zero speed region. Author

N76-18214*# Lockheed Missiles and Space Co., Huntsville, Ala.
SPACECRAFT SELF-CONTAMINATION DUE TO BACK-SCATTERING OF OUTGAS PRODUCTS Interim Report
S. J. Robertson Jan. 1976 44 p refs
(Contract NAS8-31440)
(NASA-CR-144197; LMSC-HREC-TR-D496676) Avail: NTIS HC $4.00 CSCL 22B

The back-scattering of outgas contamination near an orbiting spacecraft due to intermolecular collisions was analyzed. Analytical tools were developed for making reasonably accurate quantitative estimates of the outgas contamination return flux, given a knowledge of the pertinent spacecraft and orbit conditions. Two basic collision mechanisms were considered: (1) collisions involving only outgas molecules (self-scattering) and (2) collisions between outgas molecules and molecules in the ambient atmosphere (ambient-scattering). For simplicity, the geometry was idealized to a uniformly outgassing sphere and to a disk oriented normal to the freestream. The method of solution involved an integration of an approximation of the Boltzmann kinetic equation known as the BGK (or Krook) model equation. Results were obtained in the form of simple equations relating outgas return flux to spacecraft and orbit parameters. Results were compared with previous analyses based on more simplistic models of the collision processes. Author

N76-18215*# Chrysler Corp., New Orleans, La. Data Management Services.
AERODYNAMIC RESULTS OF WIND TUNNEL TESTS ON A 0.010-SCALE MODEL (32-OTS) SPACE SHUTTLE INTEGRATED VEHICLE IN THE AEDC VKF-40-INCH SUPERSONIC WIND TUNNEL (IA61)
J. J. Daileda (Rockwell Intern. Corp., Downey, Calif.) Jan. 1976 642 p
(Contract NAS9-13247)
(NASA-CR-144587; DMS-DR-2143) Avail: NTIS HC $16.25 CSCL 22B

Plotted and tabulated aerodynamic coefficient data from a wind tunnel test of the integrated space shuttle vehicle are presented. The primary test objective was to determine proximity force and moment data for the orbiter/external tank and solid rocket booster (SRB) with and without separation rockets firing for both single and dual booster runs. Data were obtained at three points (t = 0, 1.25, and 2.0 seconds) on the nominal SRB separation trajectory. Author

N76-18216*# TRW Systems Group; Redondo Beach, Calif. Electronic Systems Lab.
VERIFICATION TEST RESULTS OF APOLLO STABILIZATION AND CONTROL SYSTEMS DURING UNDOCKED OPERATIONS
E. L. Copeland and R. L. Haken 14 Jun. 1974 146 p refs
(Contract NAS9-13834)
(NASA-CR-147452; TRW-25990-H037-R0-00) Avail: NTIS HC $6.00 CSCL 22B

The results are presented of analysis and simulation testing of both the Skylark 1 reaction control system digital autopilot (RCS DAP) and the thrust vector control (TVC) autopilot for use during the undocked portions of the Apollo/Soyuz Test Project Mission. The RCS DAP testing was performed using the Skylab Functional Simulator (SLFS), a digital computer program capable of simulating the Apollo and Skylab autopilots along with vehicle dynamics including bending and sloshing. The model is used to simulate three-axis automatic maneuvers along with pilot controlled manual maneuvers using the RCS DAP. The TVC autopilot was tested in two parts. A classical stability analysis was performed on the vehicle considering the effects of structural bending and sloshing when under control of the TVC autopilot. The time response of the TVC autopilot was tested using the SLFS. Results indicate that adequate performance stability margins can be expected for the CSM/DM configuration when under the control of the Apollo control systems tested. Author

N76-18217*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
PRELIMINARY INPUT TO THE SPACE SHUTTLE REACTION CONTROL SUBSYSTEM FAILURE DETECTION AND IDENTIFICATION SOFTWARE REQUIREMENTS (UNCONTROLLED)
Edward Bergmann Jan. 1976 71 p refs
(Contract NAS9-13809)
(NASA-CR-147461; C-4576) Avail: NTIS HC $4.50 CSCL 22B

The current baseline method and software implementation of the space shuttle reaction control subsystem failure detection and identification (RCS FDI) system is presented. This algorithm is recommended for conclusion in the redundancy management (RM) module of the space shuttle guidance, navigation, and control system. Supporting software is presented, and recommended for inclusion in the system management (SM) and display and control (D&C) systems. RCS FDI uses data from sensors in the jets, in the manifold isolation valves, and in the RCS fuel and oxidizer storage tanks. A list of jet failures and fuel imbalance warnings is generated for use by the jet selection algorithm of the on-orbit and entry flight control systems, and to inform the crew and ground controllers of RCS failure status. Manifold isolation valve close commands are generated in the event of failed on or leaking jets to prevent loss of large quantities of RCS fuel. Author

N76-18218*# Chrysler Corp., New Orleans, La.
AN INVESTIGATION OF DRAG REDUCTION FAIRINGS ON THE SPACE SHUTTLE VEHICLE 5 CONFIGURATION (MODEL 74-OTS) IN THE MSFC 14 INCH TRISONIC WIND TUNNEL (FA14)
P. E. Ramsey Feb. 1976 438 p
(Contract NAS9-13247)
(NASA-CR-144593; DMS-DR-2274) Avail: NTIS HC $11.75 CSCL 22B

An experimental investigation was conducted in the MSFC 14-inch TWT (FA14, TWT 600) to determine the static stability and drag on a 0.004 scale model of the shuttle ascent configuration. The primary objective was to study the possibility of reducing the launch vehicle drag by using Orbiter/ET/SRB fairings, streamlined orbiter fore and aft attach structures, SRB and ET alternative nose configurations, and devices for modifying the flow between the orbiter and ET. The secondary objective was to determine the longitudinal and directional characteristics of the ascent configuration with the most promising of the drag reduction devices installed. Data were obtained for a Mach number range of 0.6 through 4.96 and angles of attack from -5 through 5 degrees at zero degrees side slip angle. Author

N76-18219*# Chrysler Corp., New Orleans, La. Space Div.
UPPER WING SURFACE BOUNDARY LAYER MEASUREMENTS AND STATIC AERODYNAMIC DATA OBTAINED ON A 0.015-SCALE MODEL (42-0) OR THE SSV ORBITER CONFIGURATION 140A/B IN THE LTV HSWT AT A MACH NUMBER OF 4.6 (LA58)
J. W. Ball and R. H. Lindahl Feb. 1976 383 p
(Contract NAS9-13247)
(NASA-CR-144592; DMS-DR-2215) Avail: NTIS HC $10.75 CSCL 22B

The purpose of the test was to investigate the nature of the Orbiter boundary layer characteristics at angles of attack from -4 to 32 degrees at a Mach number of 4.6. The effect of large grit, employed as transition strips, on both the nature of the boundary layer and the force and moment characteristics were investigated along with the effects of large negative elevon deflection on lee side separation. In addition, laminar and turbulent boundary layer separation phenomena which could cause asymmetric flow separation were investigated. Author

N76-18220*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPUTER-AIDED TELESCOPE POINTING SYSTEM

UTILIZING A VIDEO STAR TRACKER
James P. Murphy, Kenneth R. Lorell, and Charles D. Swift Dec. 1975 55 p refs
(NASA-TM-X-73079; A-6365) Avail: NTIS HC $4.50 CSCL 03A

The Video Inertial Pointing (VIP) System developed to satisfy the acquisition and pointing requirements of astronomical telescopes is described. A unique feature of the system is the use of a single sensor to provide information for the generation of three axis pointing error signals and for a cathode ray tube (CRT) display of the star field. The pointing error signals are used to update the telescope's gyro stabilization and the CRT display is used by an operator to facilitate target acquisition and to aid in manual positioning of the telescope optical axis. A model of the system using a low light level vidicon built and flown on a balloon-borne infrared telescope is briefly described from a state of the art charge coupled device (CCD) sensor. The advanced system hardware is described and an analysis of the multi-star tracking and three axis error signal generation, along with an analysis and design of the gyro update filter, are presented. Results of a hybrid simulation are described in which the advanced VIP system hardware is driven by a digital simulation of the star field/CCD sensor and an analog simulation of the telescope and gyro stabilization dynamics. Author

N76-18221*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE OF LI-1542 REUSABLE SURFACE INSULATION SYSTEM IN A HYPERSONIC STREAM
L. Roane Hunt, John L. Shideler, and Irving Weinstein Washington Mar. 1976 69 p refs
(NASA-TN-D-8150; L-10551) Avail: NTIS HC $4.50 CSCL 22B

The thermal and structural performance LI-1542 reusable surface insulation (RSI) tiles was investigated. The test panel was designed to represent part of the surface structure on a space shuttle orbiter fuselage along a 1250 K isotherm. Aerothermal tests were conducted at a free-stream Mach number of 6.6, a total temperature of 1820 K, Reynolds numbers of 2 million and 5 million per meter, and dynamic pressures of 26 and 65 kPa. The RSI tiles demonstrated good thermal protection and structural integrity. High temperatures were caused by misalinement in tile height, offset the tile longitudinal alinement, and leakage around thermal seals when differential pressure existed across the panel. The damage tolerance of LI-1542 RSI appeared high. The tile coating crazed early in the test program, but this did not effect the tile integrity. Erosion of the tile edges occurred at forward-facing steps and at the ends of longitudinal gaps because of particle impacts and flow shear. Author

N76-18222*# Transemantics, Inc., Washington, D.C.
NEW DESIGN FEATURES OF THE VENERA-9 AND -10 PROBES
Ye. Ivanov Washington NASA Feb. 1976 7 p Transl. into ENGLISH from Krasnaya Zvezda (USSR), 24 Oct. 1975 p 1/3
(Contract NASw-2792)
(NASA-TT-F-16888) Avail: NTIS HC $3.50 CSCL 22B

The major design advance of the Venera-9 and -10 is that the orbital module is preserved and functions as a Venus satellite. The main design objective was to retransmit telemetry and television signals from the descent module which can be transmitted to the orbital module at a low power level, thus providing the opportunity for increased information volume transmitted during its short lifetime. Additional problems were associated with timing the direct visibility between the descent and orbital modules and the programmed variable velocity of the descent module for studying particular layers of the atmosphere. Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-18223*# Alaska Univ., Fairbanks. Geophysical Inst.
AMPS DEFINITION STUDY ON OPTICAL BAND IMAGER AND PHOTOMETER SYSTEM (OBIPS) Final Report
T. Neil Davis, C. S. Deehr, T. J. Hallinan, and E. M. Wescott Sep. 1975 195 p refs
(Contract NAS9-14645)
(NASA-CR-147484) Avail: NTIS HC $7.50 CSCL 14B

A study was conducted to define the characteristics of a modular optical diagnostic system (OBIPS) for AMPS, to provide input to Phase B studies, and to give information useful for experiment planning and design of other instrumentation. The system described consists of visual and UV-band imagers and visual and UV-band photometers; of these the imagers are most important because of their ability to measure intensity as a function of two spatial dimensions and time with high resolution. The various subsystems of OBIPS are in themselves modular with modules having a high degree of interchangeability for versatility, economy, and redundancy. Author

N76-18224*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR ENERGY MONITOR IN SPACE (SEMIS)
Matthew P. Thekaekara Mar. 1974 40 p refs Presented at Symp. on Solar Radiation Meas. and Instrumentation, Rockville, Md., 13-15 Nov. 1973
(NASA-TM-X-70623; X-912-74-78) Avail: NTIS HC $4.00 CSCL 03B

Measurements made at high altitudes from aircraft have resulted in the establishment of standard values of the solar constant and extraterrestrial solar spectral irradiance. These standard values and other solar spectral curves are described. The problem of possible variations of the solar constant and solar spectrum and their influence on the earth-atmosphere system and weather related phenomena is examined. It is shown that the solar energy input parameters should be determined with considerably greater accuracy and precision than has been possible. An instrument package designed as a compact, low weight solar energy monitor in space (SEMIS) is described. Author

N76-18225*# TRW Systems Group, Redondo Beach, Calif.
A STUDY OF LOW COST APPROACHES TO SCIENTIFIC EXPERIMENT IMPLEMENTATION FOR SHUTTLE LAUNCHED AND SERVICED AUTOMATED SPACECRAFT Final Report
17 Oct. 1975 157 p refs
(Contract NASw-2717)
(NASA-CR-146310) Avail: NTIS HC $6.75 CSCL 14B

Cost reductions that can be obtained in experiment instrumentation by the use of standardized electronics and by the relaxation of instrument reliability requirements are studied. The feasibility of using standardized equipment for experiment instrumentation is assessed and a system design approach that most effectively incorporates standardized equipment is developed. The level and form of modularization that is appropriate for the standardized equipment is determined. Mission assurance aspects of instrument development are examined to determine the cost reductions that might be derived from the relaxation of reliability requirements and to formulate a systematic approach to the optimization of mission assurance cost reductions. The results of the analyses are applied to a representative model HEAO payload in order to provide a concrete example of the cost reductions that can be achieved by a standardized approach to the instrument electronics. Author

N76-18226*# General Electric Co., Philadelphia, Pa. Space Div.
FINAL DEFINITION AND PRELIMINARY DESIGN STUDY FOR THE INITIAL ATMOSPHERIC CLOUD PHYSICS LABORATORY, A SPACELAB MISSION PAYLOAD
28 Jan. 1976 144 p Orientation Meeting held at Marshall Space Flight Center, Huntsville, Ala., 28 Jan. 1976
(Contract NAS8-31845)
(NASA-CR-144188; DR-MA-03) Avail: NTIS HC $6.00 CSCL 14B

The following areas related to the final definition and preliminary design study of the initial atmospheric cloud physics

laboratory (ACPL) were covered: (1) proposal organization, personnel, schedule, and project management, (2) proposed configurations, (3) study objectives, (4) ACPL experiment program listing and description, (5) mission/flight flexibility and modularity/commonality, (6) study plan, and (7) description of following tasks: requirement analysis and definition task flow, systems analysis and trade studies, subsystem analysis and trade studies, specifications and interface control documents, preliminary design task flow, work breakdown structure, programmatic analysis and planning, and project costs. Finally, an overview of the scientific requirements was presented. Y.J.A.

N76-18227*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETIC SUSPENSION AND POINTING SYSTEM Patent Application
Willard W. Anderson and Nelson J. Groom, inventors (to NASA) Filed 27 Feb. 1976 10 p
(NASA-Case-LAR-11889-1; US-Patent-Appl-SN-662182) Avail: NTIS HC $3.50 CSCL 14B

Apparatus for providing accurate pointing of instruments on a carrier vehicle and for providing isolation of the instruments from the vehicle's motion disturbances is described. The apparatus includes two assemblies, with connecting interfaces, each assembly having a separate function. The first assembly is attached to the carrier vehicle and consists of an azimuth gimbal and an elevation gimbal which provide coarse pointing of the instruments by allowing two rotations of the instruments relative to the carrier vehicle. The second or vernier pointing assembly is made up of magnetic suspension and fine pointing actuators, roll motor segments, and an instrument mounting plate around which a continuous annular rim is attached which provides appropriate magnetic circuits for the actuators and the roll motor segments. The vernier pointing assembly is attached to the elevation gimbal and provides vernier attitude fine pointing and roll positioning of the instruments as well as six degree-of-freedom isolation from carrier motion disturbances. NASA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-18228*# TRW Systems Group, Redondo Beach, Calif.
USER'S MANUAL FOR THE SHUTTLE ELECTRIC POWER SYSTEM ANALYSIS COMPUTER PROGRAM (SEPS), VOLUME 2 OF PROGRAM DOCUMENTATION
R. W. Bains, H. A. Herwig, J. K. Luedeman, and E. M. Torina Jun. 1974 143 p
(Contract NAS9-13834)
(NASA-CR-147450; TRW-25990-H036-RO-00-Vol-2; TRW-Note-74-FMT-947-Vol-2) Avail: NTIS HC $6.00 CSCL 09C

The Shuttle Electric Power System Analysis SEPS computer program which performs detailed load analysis including predicting energy demands and consumables requirements of the shuttle electric power system along with parameteric and special case studies on the shuttle electric power system is described. The functional flow diagram of the SEPS program is presented along with data base requirements and formats, procedure and activity definitions, and mission timeline input formats. Distribution circuit input and fixed data requirements are included. Run procedures and deck setups are described. Author

N76-18229*# Thiokol Chemical Corp., Elkton, Md.
FEASIBILITY OF AN ADVANCED THRUST TERMINATION ASSEMBLY FOR A SOLID PROPELLANT ROCKET MOTOR Final Report
30 Jun. 1975 97 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953692)
(NASA-CR-146312; E41-75) Avail: NTIS HC $5.00 CSCL 21H

A total of 68 quench tests were conducted in a vented bomb assembly (VBA). Designed to simulate full-scale motor operating conditions, this laboratory apparatus uses a 2-inch-diameter, end-burning propellant charge and an insulated disc of consolidated hydrated aluminum sulfate along with the explosive charge necessary to disperse the salt and inject it onto the burning surface. The VBA was constructed to permit variation of motor design parameters of interest; i.e., weight of salt per unit burning surface area, weight of explosive per unit weight of salt, distance from salt surface to burning surface, incidence angle of salt injection, chamber pressure, and burn time. Completely satisfactory salt quenching, without re-ignition, occurred in only two VBA tests. These were accomplished with a quench charge ratio (QCR) of 0.023 lb salt per square inch of burning surface at dispersing charge ratios (DCR) of 13 and 28 lb of salt per lb of explosive. Candidate materials for insulating salt charges from the rocket combustion environment were evaluated in firings of 5-inch-diameter, uncured end-burner motors. A pressed, alumina ceramic fiber material was selected for further evaluation and use in the final demonstration motor. Author

N76-18230*# TRW Systems Group, Redondo Beach, Calif. Electrical Power Section.
PROGRAM MANUAL FOR THE SHUTTLE ELECTRIC POWER SYSTEM ANALYSIS COMPUTER PROGRAM (SEPS), VOLUME 1 OF PROGRAM DOCUMENTATION
R. W. Bains, H. A. Herwig, J. K. Luedeman, and E. M. Torina Jun. 1974 314 p
(Contract NAS9-13834)
(NASA-CR-147451; TRW-25990-H040-R0-00-Vol-1; TRW-Note-74-FMT-946-Vol-1) Avail: NTIS HC $9.75 CSCL 09C

The Shuttle Electric Power System (SEPS) computer program is considered in terms of the program manual, programmer guide, and program utilization. The main objective is to provide the information necessary to interpret and use the routines comprising the SEPS program. Subroutine descriptions including the name, purpose, method, variable definitions, and logic flow are presented. Author

N76-18231*# Aerojet Liquid Rocket Co., Sacramento, Calif.
SPACE SHUTTLE ORBITAL MANEUVERING ENGINE PLATELET INJECTOR PROGRAM Summary Report
1 Dec. 1975 49 p refs
(Contract NAS9-13133)
(NASA-CR-147480; Rept-13133-F-2) Avail: NTIS HC $4.00 CSCL 21H

A platelet-face injector for the fully reusable orbit maneuvering system OMS on the space shuttle was evaluated as a means of obtaining additional design margin and low cost. Performance, heat transfer, and combustion stability were evaluated over the anticipated range of OMS operating conditions. The effects of acoustic cavity configuration on combustion stability, including cavity depth, open area, inlet contour, and other parameters, were investigated using sea level bomb tests. Prototype injector and chamber behavior was evaluated for a variety of conditions; these tests examined the effects of film cooling, helium saturated propellants, chamber length, inlet conditions, and operating point, on performance, heat transfer and engine transient behavior. Helium bubble ingestion into both propellant circuits was investigated, as was chugging at low pressure operation, and hot and cold engine restart with and without a purge. Author

N76-18232*# IBM Federal Systems Div., Huntsville, Ala. Federal Systems Div.
DYNAMIC CHARACTERIZATION OF SOLID ROCKETS
Sep. 1973 103 p refs
(Contract NAS8-14000)
(NASA-CR-144189; IBM-73W-00271) Avail: NTIS HC $5.50 CSCL 21H

The structural dynamics of solid rockets in-general was studied. A review is given of the modes of vibration and bending that can exist for a solid propellant rocket, and a NASTRAN computer model is included. Also studied were the dynamic properties of a solid propellant, polybutadiene-acrylic acid-acrylonitrile terpolymer, which may be used in the space shuttle rocket booster. The theory of viscoelastic materials (i.e, Poisson's

ratio) was employed in describing the dynamic properties of the propellant. These studies were performed for an eventual booster stage development program for the space shuttle. J.R.T.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N76-18233*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BONDING AND COMPATIBILITY OF ALUMINUM OXIDE FIBERS IN NICKEL ALLOY COMPOSITES
Leonard J. Westfall Washington Jan. 1976 35 p refs
(NASA-TM-X-3333; E-8489) Avail: NTIS HC $4.00 CSCL 11D

Bond strength and chemical compatibility of nickel and a range of nickel alloy compositions with single-crystal Al2O3 filaments were investigated. The matrix materials studied were nickel, Ni-20Cr, Hastelloy-X, and NASA Nifeco-5. A pullout specimen was developed and used to determine the fiber matrix bond strength at room and elevated temperatures. Fiber matrix reaction data were obtained and are discussed along with the effects of a thermal anneal on the elevated-temperature bond strength of the composite systems. Good compatibility and adequate high temperature bond strength were shown for Hastelloy-X and NASA Nifeco-5, with the latter being superior. Nickel and Ni-20Cr were shown to be unacceptable matrices because of severe chemical reactions. Author

N76-18234*# Institute for Research, Inc., Houston, Tex.
DEVELOPMENT OF A PROTECTIVE DECORATIVE FIRE RESISTANT LOW SMOKE EMITTING, THERMALLY STABLE COATING MATERIAL Final Report
30 Jan. 1976 80 p
(Contract NAS9-14726)
(NASA-CR-147479) Avail: NTIS HC $5.00 CSCL 11D

The development of suitable electrocoatings and subsequent application to nonconductive substrates are discussed. Substrates investigated were plastics or resin-treated materials such as FX-resin (phenolic-type resin) impregnated fiberglass mat, polyphenylene sulfide, polyether sulfone and polyimide-impregnated unidirectional fiberglass. Efforts were aimed at formulating a fire-resistant, low smoke emitting, thermally stable, easily cleaned coating material. The coating is to be used for covering substrate panels, such as aluminum, silicate foam, polymeric structural entities, etc., all of which are applied in the aircraft cabin interior and thus subject to the spillages, scuffing, spotting and the general contaminants which prevail in aircraft passenger compartments. Author

N76-18235*# Scientific Translation Service, Santa Barbara, Calif.
SILICON NITRIDE SOLID SOLUTION IN THE TERNARY SYSTEM, Si3N4-AlN-SiO2
Nobuo Kamiya, Yoichi Koyama, and Osami Kamigaito Washington NASA Feb. 1976 13 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Tokyo), v. 83, no. 11, Nov. 1975 p 553-557
(Contract NASw-2791)
(NASA-TT-F-16904) Avail: NTIS HC $3.50 CSCL 11D

The formation of silicon nitride solid solution in the Si3N4-AlN-SiO2 system is considered, as predicted for the Si3N4-AlN-Al2O3 system, in correspondence with experimental results. Also, the possibility of new compounds consisting of Si, Al, N, and O is mentioned. Author

N76-18236*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED IMPACT-RESISTANT BORON-ALUMINUM COMPOSITES FOR USE AS TURBINE ENGINE FAN BLADES
David L. McDanels and Robert A. Signorelli [1976] 29 p refs Presented at Symp. on Failure Modes in Composites, Las Vegas, Nev., 23-24 Feb., 1976; sponsored by Am. Inst. of Mining, Metallurgical, and Petrol. Engrs.
(NASA-TM-X-71875) Avail: NTIS HC $4.00 CSCL 11D

Efforts to improve the impact resistance of B/Al are reviewed and analyzed. Thin sheet Charpy and Izod impact tests and standard full size Charpy impact tests were conducted on unidirectional and angleply composites containing 4, 5.6 and 8 mil boron in 1100, 2024, 5052 and 6061 Al matrices. Impact failure modes of B/Al are proposed in an attempt to describe the mechanisms involved and to provide insight for maximizing impact resistance. The impact strength of B/Al was significantly increased by proper selection of materials and processing. The use of more ductile matrices (1100 Al) and larger diameter (8 mil) boron fibers gave the highest impact strengths by allowing matrix shear deformation and multiple fiber breakage. Author

N76-18237*# Pennwalt Corp., King of Prussia, Pa. Technological Center.
DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT INTERIOR COATING, PHASE 1 Technical Report, 12 Nov. 1974 - 11 Jun. 1975
E. J. Bartoszek and Piero Nannelli Nov. 1975 20 p
(Contract NAS9-14403)
(NASA-CR-147499) Avail: NTIS HC $3.50 CSCL 11D

Coating formulations were developed consisting of latex blends of fluorocarbon polymers, acrylic resins, stabilizers, modifiers, other additives, and a variety of inorganic pigments. Suitable latex primers were also developed from an acrylic latex base. The formulations dried to touch in about one hour and were fully dry in about twenty-four hours under normal room temperature and humidity conditions. The resulting coatings displayed good optical and mechanical properties, including excellent bonding to (pre-treated) substrates. In addition, the preferred compositions were found to be self-extinguishing when applied to nonflammable substrates and could meet the offgassing requirements specified by NASA for the intended application. Improvements are needed in abrasion resistance and hardness. Author

N76-18238*# General Dynamics Corp., San Diego, Calif. Convair Div.
DEVELOPMENT OF LIGHTWEIGHT REINFORCED PLASTIC LAMINATES FOR SPACECRAFT INTERIOR APPLICATIONS Final Report, Oct. 1974 - Dec. 1975
Julius Hertz Dec. 1975 63 p
(Contract NAS9-13986)
(NASA-CR-147497) Avail: NTIS HC $4.50 CSCL 11D

Lightweight, Kevlar - reinforced laminating systems that are non-burning, generate little smoke in the space shuttle environment, and are physically equivalent to the fiberglass/polyimide system used in the Apollo program for non-structural cabin panels, racks, etc. Resin systems representing five generic classes were screened as matrices for Kevlar 49 reinforced laminates. Of the systems evaluated, the polyimides were the most promising with the phenolics a close second. Skybond 703 was selected as the most promising resin candidate. With the exception of compression strength, all program goals of physical and mechanical properties were exceeded. Several prototype space shuttle mobility and translation handrail segments were manufactured using Kevlar/epoxy and Kevlar-graphite/epoxy. This application shows significant weight savings over the baseline aluminum configuration used previous. The hybrid Kevlar-graphite/epoxy is more suitable from a processing standpoint. Author

N76-18239# Martin Marietta Aerospace, Orlando, Fla.
DEVELOPMENT OF CARBON FIBER-RESIN COMPOSITE MATERIALS FOR ADVANCED ABM STRUCTURES Final Report, Jun. 1974 - Dec. 1974
Frank H. Koo and Howard S. Kliger Watertown, Mass. AMMRC Sep. 1975 178 p refs
(Contract DAAG46-74-C-0127; DA Proj. 1W1-62113-A-661)

(AD-A016309; OR-13625; AMMRC-CTR-75-17) Avail: NTIS CSCL 11/4

Material specifications and process control specification were developed for carbon fiber-resin composite materials. Hoop ring tests were conducted to evaluate the tensile strength and modulus of Thornel 300/epoxy rings fabricated by wet winding and by prepreg layup techniques. For the cone frustum shell structure of an advanced interceptor, the unidirectional prepreg layup is the recommended fabrication method. Composite lamina angle tests were conducted to provide the relationship of tensile strength, modulus and Poisson's ratio with lamina angles. Thornel 300/Fiberite 934 was the composite material used. Test results show Thornel 300/Fiberite 934 will not provide the stiffness required for the Advanced ABM structure. GY70/epoxy is recommended for the follow-on development. GRA

N76-18240# Acurex Corp., Mountain View, Calif. Aerotherm Div.

AFRPL GRAPHITE PERFORMANCE PREDICTION PROGRAM. VOLUME 1: RECOMMENDATIONS FOR A STANDARDIZED ANALYTIC PROCEDURE FOR MX NOZZLE THROAT RECESSION CALCULATIONS Interim Report, May 1974 - May 1975

Andrew J. Murphy, Edward K. Chu, and John P. Kesslering Oct. 1975 116 p refs 2 Vol.

(Contract F04611-74-C-0023; Aerotherm Proj. 7113)

(AD-A016720; Aerotherm-75-143-Vol-1; AFRPL-TR-75-59-Vol-1) Avail: NTIS CSCL 11/2

A survey was taken of five solid propellant motor contractors to review current analytic techniques used to predict graphite nozzle material response. Several solutions for a baseline nozzle were conducted and gave similar results for flow field analysis, but not for boundary layer analysis. A sensitivity study was conducted on material response predictions and identified kinetic constants and heat transfer coefficient as the most important variables. Recommendations were provided for development of a standard analysis procedure. GRA

N76-18241# Acurex Corp., Mountain View, Calif. Aerotherm Div.

AFRPL GRAPHITE PERFORMANCE PREDICTION PROGRAM. VOLUME 2: ARC PLASMA GENERATOR EVALUATION OF GRAPHITE REACTION KINETICS IN ROCKET PROPELLANT ENVIRONMENTS Interim Report, May 1974 - May 1975

H. Tong, J. C. Hartman, and E. K. Chu Oct. 1975 59 p refs 2 Vol.

(Contract F04611-74-C-0023; Aerotherm Proj. 7113)

(AD-A016786; Aerotherm-75-143-Vol-2; AFRPL-TR-75-59-Vol-2) Avail: NTIS CSCL 11/2

Test gases and conditions were selected for use in the arc plasma generation simulation of advanced propellant environments. Calibration and checkout results are reported. The experimental program to determine kinetic reaction rates of carbon and graphite materials will now proceed and be completed in early 1976. GRA

N76-18242# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.

PARTICLE EMISSION AND RELATED MORPHOLOGICAL CHANGES OCCURRING DURING THE SUBLIMATION OF GRAPHITIC CARBONS Interim Report

A. Greenville Whittaker and P. L. Kintner 15 Jul. 1975 44 p refs

(Contract F04701-75-C-0076)

(AD-A015863; TR-0076(6950-07)-2; SAMSO-TR-75-188) Avail: NTIS CSCL 20/13

The mechanism of particle emission from hot graphitic carbons was studied by means of several heating and detection methods and by analysis of the emitted particles. The carbons studied are ATJS, Graph-I-Tite G, POCO9Q, spectrographic rod, pyrolytic graphite, and glassy carbon. All showed particulated mass loss in the range of 60 to 90% of the total mass loss. Generally, the results of this research are in accord with the conclusions of other investigators in that the mechanism of particulate mass loss for two-phase carbons is due mainly to preferential vaporization of the binder and the bursting of closed pores by entrapped gas. For single-phase carbons, the mechanism appears to involve undercutting resulting from inhomogeneities and the bursting of closed pores. Some of the graphitic material was transformed into linear carbon polymorphs, i.e., chaoite, carbon VI, and alpha - beta carbyne, and was emitted along with the graphitic particles. Data are cited that indicate that at approximately 3750 K particulate mass loss changes to mass loss as a result of the formation of liquid carbon. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N76-18243 Colorado State Univ., Fort Collins.

A THEORETICAL EVALUATION OF RIGID BAFFLES IN SUPPRESSION OF COMBUSTION INSTABILITY Ph.D. Thesis

Melvin Robert Baer 1975 82 p

Avail: Univ. Microfilms Order No. 76-4293

An analytical technique for the prediction of the effects of rigid baffles on the stability of liquid propellant combustors is presented. This analysis employs both two and three dimensional combustor models characterized by concentrated combustion sources at the chamber injector and a constant Mach number nozzle. An eigenfunction-matching method is used to solve the linearized partial differential equations describing the unsteady flow field for both models. Boundary layer corrections to this unsteady flow are used in a mechanical energy dissipation model to evaluate viscous and turbulence effects within the flow. An integral stability relationship is then employed to predict the decay rate of the oscillations. Results of this analysis agree qualitatively with experimental observations and show that sufficient dissipation exists to indicate that the proper mechanism of baffle damping is a fluid dynamic loss. Dissert. Abstr.

N76-18244 Nebraska Univ., Lincoln.

THERMOCHEMICAL STUDIES: ENTHALPIES OF AQUEOUS ZINC, CADMIUM, AND CARBONATE SYSTEMS Ph.D. Thesis

Robert Lee Berg 1975 146 p

Avail: Univ. Microfilms Order No. 76-4509

Thermochemical properties were determined for several chemical systems by isoperibol calorimetry at 298.15 K. The enthalpy of dilution of cadmium perchlorate was measured and found to be in good agreement with literature values after certain corrections. The dissolution enthalpy of zinc oxide in hydrochloric acid was determined at concentrations nearly identical with literature reactions of zinc metal with hydrochloric acid. The enthalpies of dilution for sodium carbonate and sodium bicarbonate solutions were also measured. The dilution curves for the pure materials are reported. The first and second ionization enthalpies of carbonic acid were measured and referenced to standard state conditions. On addition, the enthalpy of dissolving carbon dioxide in sodium hydroxide was determined as well as a solution of sodium carbonate and sodium bicarbonate in sodium hydroxide. Dissert. Abstr.

N76-18245* National Aeronautics and Space Administration. Pasadena Office, Calif.

AUTOMATED SYSTEM FOR IDENTIFYING TRACES OF ORGANIC CHEMICAL COMPOUNDS IN AQUEOUS SOLUTIONS Patent

Charles F. Campen, Jr., inventor (to NASA) (JPL) Issued 14 Jan. 1975 14 p Filed 22 Feb. 1972 Sponsored by NASA

(NASA-Case-NPO-13063-1; US-Patent-3,860,393; US-Patent-Appl-SN-227977; US-Patent-Class-23-230R; US-Patent-Class-23-230M; US-Patent-Class-23-232C; US-Patent-Class-23-253R; US-Patent-Class-23-254R; US-Patent-Class-23-255R; US-Patent-Class-73-23.1; US-Patent-Class-235-151.13) Avail: US Patent Office CSCL 07D

An automated system where, under computer control, traces of organic chemical compounds in aqueous solutions are separated into a plurality of families of compounds is described. Several of the families are separated as separate extracts, dissolved in organic solvents. The volume of solvent, containing each extract, is greatly reduced in a separate pre-GC unit, to increase the ratio of extract to solvent volume. The output of each pre-GC unit is supplied to a separate gas chromatograph (GC). The elution times of the peaks, exiting the various GC's, are used in the selection of peaks of interest by the computer based on the comparison of the extract types and the elution times with elution times of known compounds. Compounds are identified by the computer based on their extract types, elution times and the spectral data from the spectrometer.

Official Gazette of the U.S. Patent Office

N76-18246*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

A SYSTEM USING SOLID CERAMIC OXYGEN ELECTROLYTE CELLS TO MEASURE OXYGEN FUGACITIES IN GAS-MIXING SYSTEMS

Richard J. Williams and Oscar Mullins (Lockheed Electronics Corp., Houston) Jan. 1976 39 p refs

(NASA-TM-X-58167; JSC-09909) Avail: NTIS HC $4.00 CSCL 07D

Details are given for the construction and operation of a 101.3 kN/sq m (1 atmosphere) redox control system. A solid ceramic oxygen electrolyte cell is used to monitor the oxygen fugacity in the furnace. The system consists of a vertical quench, gas mixing furnace with heads designed for mounting the electrolyte cell and with facilities for inserting and removing the samples. The system also contains the high input impedance electronics necessary for measurements, a simplified version of a gas mixing apparatus, and devices for experiments under controlled rates of change relative to temperature and redox state. The calibration and maintenance of the system are discussed. Author

N76-18247*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF BENZO(A)PYRENE IN AIRBORNE PARTICULATES BY GAS CHROMATOGRAPHY

Eva Luedecke Feb. 1976 11 p refs

(NASA-TM-X-71872; E-8645) Avail: NTIS HC $3.50 CSCL 07D

A routine method was developed to measure benzo(a)pyrene in airborne particulates. Samples were collected on a filter and the organic portion was extracted with cyclohexane. The polynuclear hydrocarbon (PNHC) fraction was separated from the aliphatics by column chromatography. An internal standard was added to the extract and a portion of it was injected into a gas chromatograph. Although the gas chromatographic method has often been reported in the literature, satisfactory separation of benzo(a)pyrene and benzo(e)pyrene has not been achieved. With the introduction of a nematic liquid crystal as the stationary phase good separation is now possible. Author

N76-18248*# College of William and Mary, Williamsburg, Va. Dept. of Chemistry.

CHEMISTRY OF THE SYSTEM: Al2O3(c)MINUS HCL AQUEOUS Status Report No. 1

S. Y. Tyree, Jr. 14 Dec. 1975 19 p refs

(Grant NsG-1204)

(NASA-CR-146309) Avail: NTIS HC $3.50 CSCL 07D

In order to study exhaust gas chemistry for the space shuttle, the vapor pressure of 2 to 1 weight mixtures of 3-M hydrochloric acid and Al2O3 was studied over a 180 minute reaction period at 31 C. The Al2O3 sample was one of high surface area furnished by NASA Langley Research Center. A brief review is given for aqueous aluminum chemistry, and the chemical reactions of combustion products (exhaust gases) of aluminum propellant binders for the space shuttle are listed.

J.R.T.

N76-18249*# Scientific Translation Service, Santa Barbara, Calif.

CONCENTRATION PROFILES IN FRONT OF A CARBON SURFACE BURNING IN A FLOW OF OXYGEN. 1: EXPERIMENTAL RESULTS

E. Wicke and G. Wurzbacher Washington NASA Dec. 1975 28 p refs Transl. into ENGLISH from J. Heat Mass Transfer (West Ger.), v. 5, 1962 p 277-289

(Contract NASw-2483)

(NASA-TT-F-16813) Avail: NTIS HC $4.00 CSCL 21B

With a capillary suction probe made of quartz glass, samples of the gas were taken at different distances from a carbon surface burning in a stream of oxygen, and analyzed. Concentration profiles of oxygen, carbon monoxide and carbon dioxide were obtained at various carbon temperatures (1000 - 1230 C) while increasing quantities of water vapor (6.3 x 0.001 to 1.01 percent) and CC14 (0.3 percent) were mixed with the oxygen. Evaluation of the profiles by a model approximation gives a survey of the interacting influences: the primary reaction of oxygen with carbon, the Boudouard reaction, and the homogeneous CO oxidation influenced by the water vapor.

Author

N76-18250# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).

ON THE THIN-LAYER CHROMATOGRAPHIC SEPARATION OF TRIMETHYLSILYL ESTERS OF SILICIC ACIDS

D. Hoebbel and W. Wieker [1975] 6 p refs Transl. into ENGLISH from Z. Anorg. Allgem. Chem. (Leipzig), v. 405, no. 2, 1974 p 163-166

(NRC/CNR-TT-1842) Avail: NTIS HC $3.50

By means of thin layer chromatography it is possible to separate and identify trimethylsilylated mono-, di-, tri-, tetra-, cyclotri-, cyclotetra-, tricycloheptа-and double four-ring silicic acids. Author

N76-18251# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.

THE SPHERICAL BOMB METHOD FOR LAMINAR BURNING VELOCITY DETERMINATION: ANALYSIS OF GAS MOVEMENT DURING FLAME PROPAGATION

A. M. Garforth and C. J. Rallis Nov. 1975 27 p refs

(Rept-64; ISBN-0-58494-353-6) Avail: NTIS HC $4.00

A model of the gas motion during flame propagation in a spherical bomb was proposed; this model was used to construct a complete particle track plot for measurements of flame position and vessel pressure for any bomb test. These results were applied to the accurate determination of the laminar burning velocity from a knowledge of the distribution of gas pressure behind the flame front, including the average gas density there. Some accidentally obtained particle tracks for certain test firings were superimposed upon the computer plot for test and appear to largely confirm the predicted results. Author

N76-18252# Advisory Group for Aerospace Research and Development, Paris (France).

KINETIC ENERGY OF TURBULENCE IN FLAMES

K. N. C. Bray 1975 21 p refs Repr. from AGARD Conf. Proc. 164, Anal. and Numerical Methods for Invest. of Flow Fields with Chem. Reactions, especially related to Combust., May 1975

(AGARD-CP-164-Paper-II-2) Avail: NTIS HC $3.50

The exact equations of turbulent, chemically reacting flow were used, together with an order of magnitude analysis, to derive an approximate form of the turbulence kinetic energy balance equation for premixed, two-dimensional, turbulent flames at low Mach number and high Reynolds number. Plausible closure hypotheses were then introduced, in order to obtain an equation which reduces to a familiar form of the turbulence kinetic energy equation, in the case of nonreacting flow of constant density. Additional terms, related to heat release and mass transport, become important in turbulent flames. Experimentally observed effects of turbulence on a variety of turbulent flame configurations are discussed in terms of this equation. Author

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-18253 Ohio State Univ., Columbus.
A FUNDAMENTAL STUDY OF DYNAMIC METAL PLASTICITY Ph.D. Thesis
Ting Yung Wei 1975 90 p
Avail: Univ. Microfilms Order No. 76-3589

A set of uniaxial plastic constitutive equations for rate-sensitive work hardening metals was constructed based on the stress-strain-history dependent phenomena of metal plasticity. The proposed equations contain a constitutive law of flow stress and a function of dynamic initial yield stress in a general form. The former is stress-strain-history dependent while the latter is strain rate and temperature dependent. The effects of strain rate and temperature on flow stress are propagated via this history dependent constitutive law of flow stress from the initial yield. A series of experiments on annealed 1100-F aluminum was performed to study the residual heat energy as well as the mechanical behavior under dynamic loads. It was found that this set of uniaxial constitutive equations closely predict the dynamic mechanical behavior of annealed 1100-F aluminum at strain rates ranging from quasi-static to 1,320 in/in/second with a temperature varying from room temperature to 250 F. Dissert. Abstr.

N76-18254 Nebraska Univ., Lincoln.
GAS-PHASE HYDROGEN TRANSPORT IN TATANIUM Ph.D. Thesis
Kiritkumar Kantilal Shah 1975 151 p
Avail: Univ. Microfilms Order No. 76-2060

Gas phase hydrogen permeability and diffusivity were determined on hollow, cylindrical membranes of commercially pure alpha titanium. Steady-state permeation measurements on as polished and preoxidized and prenitrided membranes were obtained at temperatures between 425-800 C and hydrogen partial pressures between 0.02-0.20 torr. Nonsteady-state lagtime was also measured on the same membranes. The rate of permeation was observed to be first power pressure dependent regardless of membrane surface treatment. Correlation of membrane geometry and the rate of permeation utilizing Fick's first law indicates that phase boundary reactions play a dominant role in the overall hydrogen transport process. The mechanism of overall transport process is explained in terms of molecular hydrogen adsorption from the gas phase in the form of an adsorbed titanium hydride layer on the surface. Dissert. Abstr.

N76-18255 Ohio State Univ., Columbus.
CURRENT DISTORTION EFFECTS IN THE HIGH-FIELD GALVANOMAGNETIC PROPERTIES OF COPPER Ph.D. Thesis
Peter Maclyn Martin 1975 164 p
Avail: Univ. Microfilms Order No. 76-3493

Current distortions significantly affect the galvanomagnetic properties of polycrystalline copper in strong magnetic fields. Two current distortion mechanisms are shown to influence the magnetoresistance and Hall effect. These are (1) fluctuations in individual crystallite conductivities due to anisotropies in the Fermi surface; that is, the presence of closed, open, and extended orbit directions and (2) classical size effects in the form of scattering off the sample surfaces. Dissert. Abstr.

N76-18256 Texas A&M Univ., College Station.
CALCULATION OF SURFACE ELECTRONIC STRUCTURE OF SIMPLE METALS Ph.D. Thesis
Rodger Willard Hardy 1975 74 p
Avail: Univ. Microfilms Order No. 76-3640

Calculations were conducted of the electronic structure of the (100) surface for Li, Na, and Cs. Surface states, and the modification of the bulk states in the region near the surface, were determined. The surface charge density was calculated for Na. The ions are represented by Ashcroft local model pseudo-potentials, screened by a modified Lindhard dielectric function. The calculations involve the propagation matrix method, which is described in detail. The function and first derivative of a combination of evanescent waves and traveling waves in the bulk are matched, over a plane parallel to the surface, with evanescent waves from the vacuum. Dissert. Abstr.

N76-18257* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVICE FOR MEASURING THE FERRITE CONTENT IN AN AUSTENITIC STAINLESS-STEEL WELD Patent
Wayman N. Clotfelter and Benjamin F. Bankston, inventors (to NASA) Issued 10 Feb. 1976 5 p Filed 29 Oct. 1974 Supersedes N75-10210 (13 - 01, p 0029)
(NASA-Case-MFS-22907-1; US-Patent-3,938,037; US-Patent-Appl-SN-518546; US-Patent-Class-324-34R) Avail: US Patent Office CSCL 11F

A device is provided for measuring the ferrite content of austenitic stainless steel weld material. The device includes a base plate for rotatably mounting a mechanical vernier member, the mechanical vernier member supports a cantilever beam in a manner to provide vertical positioning of the beam. Suspended from the free end of the beam is a permanent magnet below which is positioned the specimen of austenitic weld- material which is to be tested. Strain gauges are provided on the top surface of the beam for measuring the magnetic force between the magnet and weld material by measuring the amount of downward deflection of the beam. The measurement is then converted into a reading which indicates the percentage of ferrite of the weld material in the joint.
Official Gazette of the U.S. Patent Office

N76-18258*# General Electric Co., Cincinnati, Ohio.
T-111 RANKINE SYSTEM CORROSION TEST LOOP, VOLUME 1 Final Report
R. W. Harrison, E. E. Hoffman, and J. P. Smith Jun. 1975 276 p refs
(Contract NAS3-6474)
(NASA-CR-134816-Vol-1; GESP-695-Vol-1) Avail: NTIS HC $9.25 CSCL 11F

Results are given of a program whose objective was to determine the performance of refractory metal alloys in a two loop Rankine test system. The test system consisted of a circulating lithium circuit heated to 1230 C maximum transferring heat to a boiling potassium circuit with a 1170 C superheated vapor temperature. The results demonstrate the suitability of the selected refractory alloys to perform from a chemical compatibility standpoint. Author

N76-18259*# General Electric Co., Cincinnati, Ohio.
T-111 RANKINE SYSTEM CORROSION TEST LOOP, VOLUME 2 Final Report
R. W. Harrison, E. E. Hoffman, and J. P. Smith Jun. 1975 257 p refs
(Contract NAS3-6474)
(NASA-CR-134816-Vol-2; GESP-695-Vol-2) Avail: NTIS HC $9.00 CSCL 11F
For abstract, see N76-18258.

N76-18260# Aeronautical Research Labs., Melbourne (Australia).
THE EFFECTS OF ADDITIONS OF CHROMIUM, SILVER, AND MANGANESE ON THE STRESS CORROSION BEHAVIOUR OF AN Al-Zn-Mg-Cu ALLOY
B. R. W. Hinton Jun. 1975 16 p refs
(ARL/Mat-Note-111) Avail: NTIS HC $3.50

The quantitative effects of alloying additions and an overaging heat treatment on the stress corrosion characteristics of an Al-Zn-Mg-Cu alloy were investigated. Single edge notched specimens were tested in a cantilever rig to produce crack velocity (v) versus stress intensity (K) data. Additions of Cr, Ag and Mn to the basic alloy shifted the v versus K curve towards higher K values; Cr produced the greatest shift. In the single-aged condition, at high K values, v was not affected by alloying additions. However, in the overaged condition, the additions reduced v by varying degrees in the Stage II plateau region; the combination of Cr + Ag had the greatest effect. Author

N76-18261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESCRIPTION OF A COMPUTERIZED METHOD FOR PREDICTING THERMAL FATIGUE LIFE OF METALS
D. A. Spera and E. C. Cox 1975 15 p refs Presented at Symp. on Thermal Fatigue of Mater. and Components, New Orleans, 17-18 Nov. 1975; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-71866; E-8509) Avail: NTIS HC $3.50 CSCL 11F

A computer program is described which can be used to predict the thermal fatigue life of metals and structural components from conventional metal properties. A unique feature of TFLIFE is that it calculates lives according to several different failure criteria for the same input data. These criteria are surface crack initiation, interior crack initiation, and complete fracture of both unnotched and notched fatigue specimens. Sample output tables are shown, together with results for two typical problems: (1) Thermal-mechanical fatigue of bar specimens of the tantalum alloy T-111, and (2) thermal-stress fatigue of wedge specimens of the nickel alloy B-1900. Author

N76-18262*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF FORMING METAL HYDRIDE FILMS Patent Application
Robert Steinberg, Donald L. Alger, and Dale W. Cooper, inventors (to NASA) Filed 20 Feb. 1976 13 p
(NASA-Case-LEW-12083-1; US-Patent-Appl-SN-659882) Avail: NTIS HC $3.50 CSCL 11F

A method of forming a continuous, thin film of stoichiometric metal hydride such as titanium dihydride, titanium dideuteride, or titanium ditritide on a substrate which may be of metal, glass or the like is disclosed. The substrate is first cleaned, both chemically and by off-sputtering in a vacuum chamber. In an ultrahigh vacuum system vapor deposition by a sublimator or vaporizer first coats a cooled shroud disposed around the substrate with a thin film of hydride forming metal which getters any contaminant gas molecules. A shutter is then opened to allow hydride forming metal to be deposited as a film or coating on the substrate. After the hydride forming metal coating is formed, a deuterium or other hydrogen isotopes are bled into the vacuum system and diffused into the metal film or coating to form a hydride of metal film. Higher substrate temperatures and pressures may be used if various parameters are appropriately adjusted. NASA

N76-18263*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EVALUATION OF DISPERSION STRENGTHENED NICKEL-BASE ALLOY HEAT SHIELDS FOR SPACE SHUTTLE APPLICATION Final Report
R. Johnson, Jr. and D. H. Killpatrick Washington NASA Mar. 1976 147 p refs
(Contract NAS1-11654)
(NASA-CR-2614) Avail: NTIS HC $6.00 CSCL 11F

The results obtained in a program to evaluate dispersion-strengthened nickel-base alloys for use in a metallic radiative thermal protection system operating at surface temperatures to 1477 K for the space shuttle were presented. Vehicle environments having critical effects on the thermal protection system are defined; TD Ni-20Cr characteristics of material used in the current study are compared with previous results; cyclic load, temperature, and pressure effects on sheet material residual strength are investigated; the effects of braze reinforcement in improving the efficiency of spotwelded joints are evaluated; parametric studies of metallic radiative thermal protection systems are reported; and the design, instrumentation, and testing of full scale subsize heat shield panels in two configurations are described. Initial tests of full scale subsize panels included simulated meteoroid impact tests, simulated entry flight aerodynamic heating, programmed differential pressure loads and temperatures simulating mission conditions, and acoustic tests simulating sound levels experienced during boost flight. Author

N76-18264# Los Alamos Scientific Lab., N.Mex.
FRACTURE BEHAVIOR OF A Pt-30 PERCENT W ALLOY BETWEEN ROOM TEMPERATURE AND 1300 C
D. L. Rohr 1975 21 p refs Presented at the 4th Inter. Colloq. of Group Theoretical Methods in Phys., Nijmegen, Netherlands, 23 Jun. 1975 Sponsored by ERDA
(LA-UR-75-1189) Avail: NTIS HC $4.25

Pt-30 percent RH-8 percent W alloys were considered for structural applications in Radioisotopic Thermoelectric Generators for space nuclear power systems. To determine materials compatibility and structural properties thermally exposed tensile specimens were tested at temperatures between 23 and 1300 C. Auger Electron Spectroscopy of freshly fractured specimens revealed segregation of phosphorus up to 11 atomic percent at the grain boundaries which appears to be responsible for the low temperature brittle fracture. Exposure to 238PuO2 further embrittled this alloy at low temperatures. The high temperature brittle fracture behavior resembled that caused by liquid metals. Author (NSA)

N76-18265# Oak Ridge National Lab., Tenn.
MECHANICAL AND PHYSICAL PROPERTIES OF 2 1/4 Cr-1 Mo STEEL IN SUPPORT OF CRBRP STEAM GENERATOR DESIGN
C. R. Brinkman, R. K. Williams, R. L. Klueh, and T. L. Hebble 1975 43 p refs Presented at Intern. Conf. on Mater. for Nucl. Steam Generators, Gatlinburg, Tenn., 9 Sep. 1975 Submitted for publication Sponsored by ERDA
(Conf-750911-1) Avail: NTIS HC $5.25

Mechanical and physical property tests on annealed 2 and 1 1/4 Cr-1 Mo steel were conducted in an effort to define behavior in support of the design of the Clinch River Breeder Reactor Plant steam generator design. Interim empirical expressions and/or data are reported from the results of tensile, creep, fatigue, creep-fatigue, subcritical crack growth, thermal conductivity, thermal diffusivity, and thermal expansion tests and analysis. The importance and complexity of obtaining valid mechanical and physical properties for the Clinch River Breeder Plant steam generator are discussed. Author (NSA)

N76-18266# California Univ., Los Angeles. Dept. of Materials.
PARTICLE SIZE DISTRIBUTION EFFECTS IN PRECIPITATION HARDENING Annual Progress Report, 16 Jan. 1974 - 15 Jan. 1975
A. J. Ardell Jan. 1975 71 p refs
(Contract AT(04-3)-34)
(UCLA-34P172-14; APR-6) Avail: NTIS HC $4.50

Results on single crystal specimens of the isothermally aged Ni-6 w/o Al alloy are described. In particular, the effect of the width of the particle size distribution is described. The experimental work on the effect of bimodal distributions of gamma prime precipitates on the critical resolved shear stress (CRSS) of aged Ni-Al single crystals is described. Work on irradiation induced void and dislocation loop formation in gamma/gamma prime alloy is reported. Also included is a brief description of some observations on irradiation effects in Ni-Si alloys. Author (NSA)

N76-18267# Clarkson Coll. of Technology, Potsdam, N.Y.
FIRST-ORDER MAGNETIC PHASE TRANSITION IN Cr-Si ALLOYS
Sigurds Arajs, K. V. Rao, L. Hedman, and H. U. Astrom 30 Oct. 1975 5 p refs
(Contract N00014-70-A-0311-0001)
(AD-A016817; TR-6-75) Avail: NTIS CSCL 11/6

Studies have clearly confirmed that there are first-order magnetic transitions in the Cr-Si system. The nature of these transitions is not completely clear at the present time. Neutron diffraction investigations are badly needed for further elucidation of the magnetic phase diagram of Cr-Si system. Further analysis of the X vs T data of Cr-Si alloys from the viewpoint of the extended Fedders and Martin theory is in progress. GRA

N76-18268# Clarkson Coll. of Technology, Potsdam, N.Y.
NEEL TEMPERATURES AND ANOMALIES IN ELECTRICAL TRANSPORT PROPERTIES OF ANTIFERROMAGNETIC BINARY CHROMIUM ALLOYS
Sigurds Arajs, Elmer E. Naderson, K. V. Rao, and H. U. Astrom 1 Nov. 1975 6 p refs
(Contract N00014-70-A-0311-0001)
(AD-A016818; TR-7-75) Avail: NTIS CSCL 11/6

The Neel temperatures (T sub N) have been determined by the d rho/dT method (where rho is the electrical resistivity and T the absolute temperature) for chromium alloys containing the elements Al, Co, Ge, Ir, Fe, Mo, Ni, Nb, Os, Ru, Si, Ta, Ti, V, and W. The so-called 'well-behaved' solutes Mo, Nb, Os, Ru, Ta, Ti, W, and V, and possibly Si and Ge, behave as expected according to the simple theory by Fedders and Martin. The other solutes exhibit more or less complicated effects which cannot successfully be explained by existing theories of itinerant

electron antiferromagnetism. The composition dependence of T sub N for various solutes has been correlated with the detailed behavior of rho in the neighborhood of T sub N. In the case of the 'well-behaved' solutes, the rho data indicate that the commensurable magnetic structure gives rise to large anomalies which are likely due to the magnetic super-zone boundaries. On the other hand, the rho anomalies for incommensurable alloys are small and possibly result from the combined effects of Fermi surface nesting and changes in the scattering relaxation time. Author (GRA)

N76-18269# Naval Research Lab., Washington, D.C.
FURTHER OBSERVATIONS ON A533-B STEEL PLATE TAILORED FOR IMPROVED RADIATION EMBRITTLEMENT RESISTANCE Interim Report
J. Russell Hawthorne 22 Sep. 1975 21 p refs
(Contracts AT(49-5)-2110; AT(49-25)-1003)
(AD-A016094; NRL-7917) Avail: NTIS CSCL 11/6

A series of advanced investigations on the radiation performance of four 6-in.-thick plates from a large (30-ton) commercial melt of A533-B steel is described. The melt represented the first commercial-scale demonstration test of improved radiation embrittlement resistance through the control (minimization) of selected residual impurity elements. Melt specifications emphasized a low copper and phosphorus content; one half of the melt was modified however by a copper addition (copper content increased from 0.03% to 0.13%). Initial plate tests described superior 550F (288C) radiation resistance, in terms of notch ductility retention, for the primary melt composition and verified the detrimental influence of impurity copper on irradiation behavior. GRA

N76-18270# Army Materials and Mechanics Research Center, Watertown, Mass.
THE DIFFUSION OF ANTIMONY OF ALPHA IRON Final Report
Gordon A. Bruggeman Aug. 1975 16 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A016133; AMMRC-TR-75-18) Avail: NTIS CSCL 11/6

Diffusion coefficients of antimony in alpha iron were determined in the temperature range 700 to 900C using the residual activity method. Specimens were large-grained polycrystals for the higher temperature measurements and single crystals for the lower temperature measurements. The activation energy (reported in calories/mole) is approximately equal to that measured for iron self-diffusion in this same temperature range, although the antimony diffusion coefficients are a factor of ten larger than the iron self-diffusion coefficients. The potential for strongly coupled vacancy-antimony motions is demonstrated, based on the observed enhancement of iron self-diffusion in dilute iron-antimony alloys. Finally, molybdenum is shown to have a negligible effect on the diffusion of antomony in alpha iron. These results are discussed in relation to the phenomenon of temper brittleness in steels. Embrittlement kinetics in iron-antimony alloys are shown to be consistent with an antimony diffusion-controlled segregation mechanism. GRA

N76-18271# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
CORRELATION OF MICROSTRUCTURE WITH FRACTURE TOUGHNESS PROPERTIES IN METALS, PART 2 Final Report, 21 Nov. 1973 - 21 Jan. 1975
Richard E. Lewis and Frank A. Crossley 21 Jan. 1975 67 p refs
(Contract N00019-74-C-0161)
(AD-A015977; LMSC-D454884-Pt-2) Avail: NTIS CSCL 11/6

Ti-6Al-4V alloy in three mill product forms and Ti-6Al-6V-2Sn-0.7Fe-0.7Cu (Ti-662) alloy in one product form were studied for the purpose of establishing a correlation between microstructures and fracture toughness. The Ti-6Al-4V mill products were 1- and 2.4-in. plates and 4- x 4-in. forged billets. The Ti-662 product was 1-in. plate. Alloy, mill produce, processing and heat-treatment variables produced 21 microstructural conditions, complementing the 28 conditions studied in a previous contract with Naval Air Systems Command, Contract N00019-72-C-0545. Tension test, fracture toughness, salt-water stress-corrosion crack-growth threshold, and fatigue crack growth rate properties were determined. Light optical microscopy, scanning electron microfractography, and transmission electron microscopy were the metallographic means employed. GRA

N76-18272# Massachusetts Inst. of Tech., Cambridge.
GROWTH OF MULTICOMPONENT COMPOSITES FROM THE MELT Final Report, Mar. 1971 - Jul. 1974
Kenneth P. Young, Edmund M. Dunn, Leo Buchakjian, Roy M. Sharp, and Merton C. Flemings Aug. 1975 91 p refs
(Contract F33615-71-C-1374; AF Proj. 7353)
(AD-A015831; AFML-TR-75-16) Avail: NTIS CSCL 11/6

An experimental investigation of interface stability during plane front solidification of the two phase alpha plus epsilon region of the Al-Cu-Ni system has been conducted. This has shown that in this region, consistent with those previously examined, interface stability in plane front solidification can be satisfactorily predicted with the aid of a simple constitutional supercooling theory developed in earlier work. Further experimental work has been conducted on the effects of shape and direction variations on both the binary Al-Cu and ternary Al-Cu-Ni eutectic in-situ composites. These are discussed with respect to their influence on the rod on lamellae alignment and consequently the mechanical properties of the composite. Experimental results for the binary Al-Cu system and the ternary Al-Cu-Ni system give good agreement with theory. GRA

N76-18273# Ohio State Univ., Columbus.
EFFECTS OF TEMPERATURE ON THE KINETICS OF PASSIVE FILM GROWTH ON IRON Technical Report, 1 Mar. 1974 - 28 Feb. 1975
C. N. Lukac, J. B. Lumsden, Z. Smialowska, and R. W. Staehle Sep. 1975 45 p refs
(Contract N00014-67-A-0232-0006; NR Proj. 036-085)
(AD-A015716; Rept-3003-Al; TR-6) Avail: NTIS CSCL 11/6

Ellipsometry was used to investigate the effects of temperature and potential on the growth kinetics of passive films on iron exposed to a pH 8.6 borate buffer solution. It was found that over the temperature range of 0.80C the growth kinetics could be described with an equal degree of confidence by either logarithmic, inverse logarithmic, or a modified form of inverse logarithmic kinetics. None of the existing models for the film growth were found to be completely consistent with the temperature and potential dependencies of the growth constants. GRA

N76-18274# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
THE EVALUATION OF Ti-6Al-6V-2Sn PRE-ALLOYED POWDER PROCESSING Final Report, 15 Apr. 1973 - 31 Jan. 1975
C. S. Cook and A. R. Vaia Jul. 1975 146 p refs
(Contract F33615-73-C-5107; AF Proj. 7351)
(AD-A015730; AFML-TR-75-65) Avail: NTIS CSCL 11/6

The effects of input material and powder production method on the properties of Ti-6Al-6V-2Sn powder and hot isostatically pressed powder compacts have been evaluated. The variations in input material studied were material form, structure, and chemistry while the two powder production methods examined were the solid state hydride-dehydride (HD) process and the experimental molten state, Westinghouse Durarc (Registered Tradename) process. Author (GRA)

N76-18275# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EFFECTS OF PURITY AND PROCESSING ON THE EXFOLIATION CORROSION BEHAVIOR OF 7X75 ALUMINUM PLATE Final Report, Mar. 1974 - Jan. 1975
Peter J. Blau Jul. 1975 22 p refs
(AF Proj. 7351)
(AD-A015728; AFML-TR-75-43) Avail: NTIS CSCL 13/8

The effect of varying iron and silicon content on the exfoliation corrosion behavior of two 7x75 type wrought aluminum alloys was investigated using the ASTM EXCO test. One series of alloy plates (5/8 inch thick) was basically the composition of 7475 with total iron and silicon varying in five steps between 0.03 and 0.31 weight percent. The other series contained Zr in place of Cr in the basic composition, and had a comparable variation in iron and silicon content. Each of the two series was

processed both in the standard T651 temper and by a thermomechanical process (TMP). Twenty different combinations of composition and processing were studied this way. Test results showed that, in general, the variation in iron and silicon content had no significant effect on exfoliation resistance in either temper or alloy series. Corrosive attack on the TMP coupons was more uniform than on the T651 coupons. Long subsurface cracks were observed in the T651 coupons. Machined sides of the TMP coupons showed almost no attack, while those of the T651 coupons pitted. The depth of attack was about 1.5 times greater on the rolled surfaces of T651 coupons compared to TMP coupons. End-grain attack depth of T651 coupon sides was three times that of TMP coupon sides. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-18276*# Battelle Columbus Labs., Ohio.
SPACE SHUTTLE NONMETALLIC MATERIALS AGE LIFE PREDICTION Final Report
G. David Mendenhall, John A. Hassell, and Richard A. Nathan Aug. 1975 107 p
(Contract NAS9-14096)
(NASA-CR-147463) Avail: NTIS HC $5.50 CSCL 11G

The chemiluminescence from samples of polybutadiene, Viton, Teflon, Silicone, PL 731 Adhesive, and SP 296 Boron-Epoxy composite was measured at temperatures from 25 to 150 C. Excellent correlations were obtained between chemiluminescence and temperature. These correlations serve to validate accelerated aging tests (at elevated temperatures) designed to predict service life at lower temperatures. In most cases, smooth or linear correlations were obtained between chemiluminescence and physical properties of purified polymer gums, including the tensile strength, viscosity, and loss tangent. The latter is a complex function of certain polymer properties. Data were obtained with far greater ease by the chemiluminescence technique than by the conventional methods of study. The chemiluminescence from the Teflon (Halon) samples was discovered to arise from trace amounts of impurities, which were undetectable by conventional, destructive analysis of the sample. Author

N76-18277# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
COMPARISON OF METHODS FOR EVALUATING THE DEGREE OF POLYMERIZATION OF SILICATE MELTS
O. A. Esin 1976 28 p refs Transl. into ENGLISH from Tr. Inst. Met., Akad. Nauk SSSR Ural. Nauchn. Tsentr. (Sverdlovsk), part 4, no. 24, 1972 p 27-44
(NRC/CNR-TT-1845) Avail: NTIS HC $4.00

Recent investigations dealing with the application of physical chemistry of polymers to molten silicates are critically reviewed and to some extent expanded. Author

N76-18278*# Solar, San Diego, Calif. Research Dept.
FIRE RESISTANT RESILIENT FOAMS Final Report, 1 Jul. 1975 - 16 Feb. 1976
John Gagliani Feb. 1976 72 p refs
(Contract NAS9-14718)
(NASA-CR-147496; SO-6-4446-0) Avail: NTIS HC $4.50 CSCL 11D

Primary program objectives were the formulation, screening, optimization and characterization of open-cell, fire resistant, low-smoke emitting, thermally stable, resilient polyimide foams suitable for seat cushions in commercial aircraft and spacecraft. Secondary program objectives were to obtain maximum improvement of the tension, elongation and tear characteristics of the foams, while maintaining the resiliency, thermal stability, low smoke emission and other desirable attributes of these materials. Author

N76-18279# Battelle Columbus Labs., Ohio.
STRENGTH-SIZE RELATIONSHIPS IN CERAMIC MATERIALS. 1: INVESTIGATION OF A COMMERCIAL ALUMINA. 2: EFFECT OF FLAW SHAPE ON STRENGTH OF CERAMICS Technical Report, Oct. 1974 - Sep. 1975
G. K. Bansal, W. H. Duckworth, and D. E. Niesz Oct. 1975 34 p refs
(Contract N00014-73-C-0408; NR Proj. 032-541)
(AD-A016835; TR-4) Avail: NTIS CSCL 11/2

Bend strengths of a commercial sintered alumina, 3M Company's Alsimag 614, are reported. Fracture stresses in specimens differing in each linear dimension by a factor of five were measured at room temperature under environmental conditions which either minimized or enhanced subcritical crack growth prior to catastrophic fracture. Strength was found to be dependent on specimen size under both test conditions. Fractographic identification of strength-controlling flaws, coupled with the analysis of strength-size data, indicated a limited applicability of Weibull's statistical approach. GRA

N76-18280# Georgia Inst. of Tech., Atlanta. School of Textile Engineering.
DEVELOPMENT OF POLYESTER/WOOL UNIFORM FABRICS WITH IMPROVED DURABILITY AND APPEARANCE Final Technical Report, 15 May 1972 - 30 Nov. 1974
W. C. Carter and S. K. Henson Aug. 1975 144 p refs
(Contract F33615-72-C-1822; AF Proj. 7320)
(AD-A016769; AFML-TR-75-98) Avail: NTIS CSCL 11/5

The mechanism of 'frosting' of polyester/wool uniform fabrics has been established. An exploratory research and development program has been carried out to establish those factors in the composition, construction, and processing of polyester/wool uniform fabrics which contribute to their wearing characteristics, particularly their pilling and frosting behavior. Based on findings, six (6) specification fabrics exhibiting improved wear performance have been prepared for a service test program. GRA

N76-18281# California Univ., Berkeley. Dept. of Chemical Engineering.
VISCOELASTIC PROPERTIES OF ENTANGLED POLYMERS. 1: THE ELASTICALLY COUPLED ENTANGLEMENT MODEL
David R. Hansen, Michael C. Williams, and Mitchel Shen 1 Oct. 1975 57 p refs
(Contract N00014-75-C-0955)
(AD-A015661; TR-4) Avail: NTIS CSCL 11/9

The bead-and-spring model of Rouse, Bueche and Zimm is extended to describe the viscoelastic behavior of polymers with chain entanglements. Motion of the macromolecules is retarded by the presence of entanglements with neighboring chains. This effect is in part represented by selected beads along the chain having enhanced friction coefficients. These selected beads may have values of friction coefficients that are uniformly higher than the unentangled beads, or are progressively higher as a function of the position along the chain. Major improvements in the model result when these entangled points are also assumed to be elastically coupled to the surrounding medium. This coupling is modelled by interconnecting the entangled beads with springs having low spring constants. The resulting equations of motion of the model contain a modified Zimm matrix that is nonsymmetrical. The eigenvalues were obtained numerically on the computer to yield the relaxation spectra, permitting calculation of dynamic moduli, relaxation moduli, equilibrium shear compliance and zero-shear viscosity for a series of molecular weights. Agreement with experimental data on monodisperse polystyrene was found to be excellent for all these properties. Of particular interest is the ability of the model to predict the equilibrium shear compliance as a function of molecular weight, which was not achievable by earlier theories. The sensitivity of J suber to the fitting parameters renders it a useful discriminator in selecting the best model for describing chain entanglement effects in polymer viscoelasticity. GRA

N76-18282# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Macromolecular Science.
THE ENVIRONMENTAL STRESS-CRAZING AND CRACKING IN POLYSTYRENE UNDER HIGH PRESSURE
K. Matsushige, S. V. Radcliffe, and E. Baer 30 Sep. 1975 56 p refs
(Contract N00014-75-C-0795)
(AD-A016249; TR-276) Avail: NTIS CSCL 11/9

Tensile experiments on polystyrene (PS) in various pressure-transmitting fluids were performed up to 4.0 kb to study the effects of test media on the mechanical behavior of amorphous polymers under pressure. The fracture stress of PS in silicon oil environment was found to depend strongly on the viscosity of oil and the strain-rate of tensile tests. In addition, creep fracture experiments conducted at 2.5 kb in silicon oil with different viscosities suggested that the environmental effects are governed by the rate of diffusion of the environmental liquid into the tensile specimen. It was also found, that water, which hardly affects the mechanical behavior of PS at atmospheric pressure, becomes a significant stress-cracking agent under higher pressure. GRA

N76-18283# Lehigh Univ., Bethlehem, Pa. Ceramics Research Lab.

THERMAL CONDUCTIVITY AND DIFFUSIVITY OF ENGINEERING CERAMICS Interim Technical Report

J. H. Siebeneck, B. K. Ganguly, and D. P. H. Hasselman Aug. 1975 84 p refs

(Contract N00014-67-A-0370-0011)

(AD-A015717) Avail: NTIS CSCL 11/2

This report presents preprint of technical papers prepared during the research program to-date in the form of separate chapters, as follows: (1) Effect of temperature dependence of thermal conductivity on thermal stress resistance of brittle materials, in particular aluminum oxide; (2) Effect of matrix conductivity on radiation heat transfer across spherical pores; (3) The thermal diffusivity of Al2O3-Cr2O3 solid-solutions effect of micro-cracking on the thermal diffusivity of Fe2TiO5; (5) Role of thermal diffusivity in the performance of ceramic oxide cutting-tool materials. GRA

N76-18284# Massachusetts Univ., Amherst. Materials Research Lab.

THE EFFECT OF MOLECULAR WEIGHT ON THE PHYSICAL AND MECHANICAL PROPERTIES OF ULTRA-DRAWN HIGH DENSITY POLYETHYLENE Interim Report

William G. Perkins, Numa J. Capiati, and Roger S. Porter 1 Aug. 1975 21 p refs

(Contract N00014-75-C-0686; NR Proj. 356-584)

(AD-A015698; TR-3) Avail: NTIS CSCL 11/9

A study has been made on the effects of molecular weight on the physical and mechanical properties of cold-extruded high density polyethylene, HDPE. Prior data indicate that such ultra-drawn strands contain a significant fraction of extended-chain crystals. Four HDPE samples, spanning the molecular weight range of 59,000 to 147,000 were cold extruded under the same conditions and were examined with respect to their melting point, degree of crystallinity, linear expansion coefficient, Young's modulus and tensile strength. The degree of crystallinity, linear expansion coefficient and modulus did not change significantly with molecular weight. The melting point and tensile strength do increase with increasing molecular weight. This leads to the conclusion that the amount of extended-chain crystals may increase with molecular weight. Higher molecular weight polymers are thus seen as providing a greater number of tie chains to give the fiber a higher tensile strength. GRA

N76-18285# Massachusetts Univ., Amherst. Materials Research Lab.

THE CONCEPT OF ONE POLYMER COMPOSITES MODELED WITH HIGH DENSITY POLYETHYLENE

Numa J. Capiati (Univ. Nacl. Del Sur, Bahia Blanca) and Roger S. Porter 1 Aug. 1975 25 p refs

(Contract N00014-75-C-0686; NR Proj. 356-584)

(AD-A015704; TR-4) Avail: NTIS CSCL 11/9

The effort described here is to present a novel idea in reinforced polymeric materials, the one polymer composite. This corresponds to a composite in which the matrix and reinforcement are made from different morphologies of the same polymer. As a model case, polyethylene has been used through this study; the results, nonetheless, may be generally extended to other semicrystalline thermoplastics. High modulus polyethylene fiber and film strips have been prepared by a solid-state (crystal-crystal) transformation. The resulting morphology has been subjected to intense characterization. Important characteristics of these fibers and film strips are their optical transparency and their high and time and temperature insensitive Young's moduli. Typical melting endotherms for the oriented fiber and the starting polyethylene, are shown. The melting point difference between the fiber and matrix is the defining feature for the one polymer composite. The melting point difference makes possible the dispersion of the polyethylene fibers in the melt of the polyethylene matrix. GRA

N76-18286# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

DEVELOPMENT OF A WATER SOLUBLE FOAM PACKAGING MATERIAL Final Report, Oct. 1974 - Jan. 1975

T. J. McCown and G. E. Wahlmann Jan. 1975 72 p refs

(Contract DAAK03-74-C-0185; DA Proj. 1T7-62720-D-048)

(AD-A016127; NDC-TR-75-88-FEL) Avail: NTIS CSCL 11/9

The purpose of this program was to investigate the feasibility of developing and reliably reproducing a water soluble foam from hydroxypropyl cellulose resin (Klucel) and to establish product parameters. The program was divided into two phases. In Phase I, the feasibility of extruding the water soluble, thermoplastic resin into a candidate packaging material was successfully demonstrated. Hydroxypropyl cellulose was extruded by conventional means into a loose-fill packaging foam having a compressive stiffness conforming to Federal Specification PPP-C-850, Cushioning Material, Polystyrene Expanded, Resilient, Class 4 (Extra Firm). In Phase II, the loose-fill foam product produced from this resin was tested. Additional investigations conducted on the loose-fill samples were: Effects of long and short term relative humidity exposure; and Solubility and dissolution rates in fresh and salt water. Long term humidity exposure caused the material to deteriorate and lose all foam cushioning properties. GRA

N76-18546 Societe Nationale Industrielle Aerospatiale, Cannes (France).

DIMENSIONAL STABILITY TESTS ON CURVED SANDWICH REFLECTOR [RAPPORT TECHNIQUE SUR LES ESSAIS DE STABILITE DIMENSIONNELLE D'UN REFLECTEUR SANDWICH GALBE]

I. Martinez, Carton, Fagnoni, M. Girard, A. Tardivo, Thorn, Mailfert, Gachod, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 71 p In FRENCH

(For availability see N76-18541 09-39)

(Rept-3038-CA/80)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-18287*# AeroChem Research Labs., Inc., Princeton, N.J.

NO SUB x DEPOSITED IN THE STRATOSPHERE BY THE SPACE SHUTTLE SOLID ROCKET MOTORS Final Summary Report

Harold S. Pergament, Roger D. Thorpe, and Baochuan Hwang Dec. 1975 27 p refs

(Contract NAS1-13544)

(NASA-CR-144928; AeroChem-TP-333) Avail: NTIS HC $4.00 CSCL 21I

The possible effects of the interaction of the plumes from the two solid rocket motors (SRM) from the space shuttles and mixing of the rocket exhaust products and ambient air in the base recirculation region on the total nitrous oxide deposition rate in the stratosphere were investigated. It was shown that these phenomena will not influence the total NOx deposition rate. It was also shown that uncertainties in the particle size of Al2O3, size distributions and particle/gas drag and heat transfer coefficients will not have a significant effect on the predicted NOx deposition rate. The final results show that the total mass flow of NOx leaving the plume at 30 km altitude is 4000 g./sec with a possible error factor of 3. For a vehicle velocity of 1140 meter/sec this yields an NOx deposition rate of about 3.5 g./meter. The corresponding HCl deposition rate

at this altitude is about a factor of 500 greater than this value.
Author

N76-18288# Goettingen Univ. (West Germany). Inst. fuer Physikalische Chemie.
INFLUENCE OF VARIOUS PARAMETERS ON INITIATION, STABILITY, AND LIMITS OF DETONATIONS Interim Report, 1 Jun. 1974 - 31 May 1975
W. Jost and H. G. Wagner 31 Jul. 1975 9 p
(Grant AF-AFOSR-2541-73; AF Proj. 6813; AF Proj. 9711)
(AD-A015839; AFOSR-75-1372TR; IR-2) Avail: NTIS CSCL 19/4

The propagation of spherical flames has been investigated under conditions where artificial turbulence was generated by spherical grids at a certain distance from the center. The flame propagation velocity increases when the flame passes the net. The increase of flame velocity depends on laminar flame speed, mesh size of the grid and diameter of the wire of the grid. There exists a lower limit of the Reynolds-number below which no flame acceleration occurs. GRA

N76-18289# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
HYDROGEN STORAGE AND TRANSFER Semiannual Technical Report, 1 Feb. - 31 Jul. 1975
R. B. Cole, R. S. Magee, and J. W. Hollenberg 25 Aug. 1975 89 p refs
(Contract N00014-75-C-0220; ARPA Order 2615)
(AD-A016256; ME-RT-75008) Avail: NTIS CSCL 21/4

Various modes of hydrogen storage are considered: compressed gas, liquid and solid (Hydride). Preliminary analysis of energy-storage densities and costs dictated more detailed consideration of hydrogen storage as a cryogenic liquid or metal hydride for (1) small-scale mobile storage and (2) large-scale stationary storage. Concentration was on these two modes in gathering and evaluating sufficient quantitative information to allow assessment of engineering problems and overall practicality. Liquid-hydrogen liquefaction, transfer and storage, and safety were explored. Liquid-cryogen pumping technology is reviewed with particular concern for application to airborne pumping of liquid-hydrogen. Pump types and performance are examined and technical problems identified. An examination of the state-of-the-art of metallic-hydride hydrogen storage is examined. GRA

N76-18290# Naval Academy, Annapolis, Md.
THE IGNITION OF LIQUID PROPELLANTS BY ACOUSTIC CAVITATION
Mark S. Campagna 23 May 1975 100 p refs
(AD-A015953; USNA-TSPR-65) Avail: NTIS CSCL 21/2

The subject of this report is the ignition of a liquid monopropellant by acoustic cavitation. An experimental result of this study was the successful preliminary ignition of the monopropellant by an acoustic horn-transducer assembly. Upon examination of these ignition results, it was postulated that the reaction initiated by the acoustic device would definitely result in combustion of the monopropellant under proper pressure conditions. The proceedings of the experiment are described. The writer concluded: 1. The ignition of liquid monopropellant is possible using acoustic techniques under proper conditions; 2. A value for the minimum energy density necessary to initiate the combustion sequence of the liquid monopropellant has been obtained; 3. The acoustic cavitation ignition technique is a precise, simple, and efficient method, however writer suggests more experiment for further development. Author (GRA)

N76-18291# Rockwell International Corp., McGregor, Tex.
AIR LAUNCH INSTRUMENTED VEHICLES EVALUATION (ALIVE) PROGRAM Interim Technical Report
J. D. Burton and J. E. Williamson 15 Sep. 1975 165 p refs
(Contract F04611-74-C-0009)
(AD-A015859; AFRPL-TR-75-56; R-4901) Avail: NTIS CSCL 21/8

The report presents progress to date on Program II of the Air Launch Instrumented Vehicles Evaluation Program (Contract F04611-74-C0009), under which a GFE propellant and three Modular Weapon Instrumented Vehicles prototype motors are being evaluated. An adequate data set for definition of a 5-year service life has been identified. An accelerated test approach based on this service-life definition is presented in detail. The three motors and instrumentation are described, and instrumentation calibration is discussed in detail. Tests conducted to characterize the propellant are described and data obtained are presented. The thermal and structural analyses of the three motors (conducted using the Air Force viscoelastic analysis computer code THVINC) are also presented. GRA

N76-18292# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
UNIVERSAL FUEL REQUIREMENTS
J. N. Bowden and W. W. Wimer May 1975 44 p refs
(Contract DAAK02-73-C-0221)
(AD-A016157; AFLRL-67) Avail: NTIS CSCL 21/4

To reduce the logistics problems of a mobile army, requirements for a fuel to operate satisfactorily in both diesel and turbine engines, in tropical as well as arctic climates, are suggested. The critical properties of fuels for turbine and diesel operation are examined. In the course of developing these suggested requirements, computer programs were formulated for blending hydrocarbon fractions with a base fuel to yield a fuel with desired properties for diesel and turbine operation. The effects of cetane improver and pour depressant additives on the characteristics of a 'universal fuel' are examined. GRA

N76-18293# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DIRECT UTILIZATION OF CRUDE OILS AS FUELS IN US ARMY DIESEL ENGINES
E. C. Owens and E. A. Frame Jun. 1975 84 p refs
(Contract DAAK02-73-C-0221)
(AD-A016156; AFLRL-66) Avail: NTIS CSCL 21/4

Crude oils with a wide range of properties were investigated for direct use as fuel in U.S. Army high-speed diesel engines. The distribution and availability of crude oil properties throughout the world were investigated, and these properties were divided into two groups (1) those properties which would be of importance for short-term operational effects, and (2) those properties whose effects would manifest during longer term operation. Effects of crude oil use on engine subsystem hardware such as fuel filters and fuel injection pumps were investigated, with particular attention being paid to the TCCS injection system. Performance and combustion data were determined using pre-cup and direct injection configurations of the single cylinder CLR diesel engine operating on various crude oils. Performance data, wear, and deposition effects of crude oil use were obtained using the TACOM single-cylinder diesel engine. Results of this investigation showed that a wide range of crude oils with proper selection and pretreatment are feasible emergency energy sources for U.S. Army four-cycle high-speed diesel engines. GRA

N76-18294# Stanford Research Inst., Menlo Park, Calif.
SOLID PROPELLANT KINETICS. 5: FUEL-OXIDIZER REACTION RATES FROM HETEROGENEOUS OPPOSED FLOW DIFFUSION FLAME Interim Report
C. M. Ablow and H. Wise Dec. 1974 38 p refs
(Contract N00014-70-C-0155; SRI Proj. PYU-8378; NR Proj. 092-507)
(AD-A015899) Avail: NTIS CSCL 21/2

A theoretical model is presented relating the gas dynamics and chemical kinetics of the opposed flow diffusion flame formed in the stagnation region between two opposing streams of gaseous reactants, one originating from the surface of a sublimiting solid, such as ammonium perchlorate. At low gas flows the regression rate of the solid is controlled by the physical properties of the system, including the net heat of gasification, the heat of combustion, and the transport parameters. At high gas flows a limiting solid regression rate is attained due to reaction-rate limitations that cause incomplete combustion of the reactants. The theoretical model developed for the heterogeneous opposed flow diffusion flame allows interpretation of the limit in solid regression rates in terms of global reaction kinetics. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

No abstracts in this category.

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-18295* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIABLE BEAMWIDTH ANTENNA Patent
Richard F. Schmidt, inventor (to NASA) Issued 10 Feb. 1976 11 p Filed 27 Aug. 1974 Supersedes N74-32674 (12-22, p 2667)
(NASA-Case-GSC-11862-1; US-Patent-3,938,162; US-Patent-Appl-SN-500979; US-Patent-Class-343-840; US-Patent-Class-343-837; US-Patent-Class-343-912; US-Patent-Class-343-915) Avail: US Patent Office CSCL 17B

An antenna system for single or plural beams is described, providing continuously variable beamwidth selectively in one or both of two orthogonal senses, i.e., azimuth and elevation, for either communications or angle-tracking. The system includes two parabolic cylindrical reflectors, which are respectively a main reflector and a sub-reflector; the reflectors are positioned with the focal axes. A point or multibeam (e.g. monopulse) feed is mounted adjacent the main reflector on the focal axis of the sub reflector. Beamwidth is controlled using telescoping sections on the main and sub reflectors to control the size of the surface areas. Official Gazette of the U.S. Patent Office

N76-18296 American Univ., Washington, D.C.
INTENSE FIELD EFFECTS IN MATERIALS Ph.D. Thesis
Hermenzo D. Jones 1975 70 p
Avail: Univ. Microfilms Order No. 76-3980

The interaction of atoms and solids with electromagnetic radiation was investigated using non conventional theoretical techniques. One such process is the multiphoton 1S-2S transition for a helium atom in the presence of combined intense and weak linearly polarized electromagnetic fields. The transition amplitude is calculated with the momentum-translation approximation. Non perturbative behavior of the results is exhibited at high intensities. There are also explicit many body effects found. The momentum-translation approximation for interband transitions in solids was another problem treated. The same physical problem was also investigated with a Volkov-type wave function used to represent the conduction-band electron in a calculation of the multiphoton interband transition rate induced by circularly polarized electromagnetic radiation of arbitrary intensity. The behavior of the transition rate is shown to be identical to that obtained from perturbation theory in the low-intensity domain, but deviates sharply from conventional weak-field characteristics for high intensities. Intense-field behavior in solids is found to be qualitatively different from that in atoms. Dissert. Abstr.

N76-18297 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL VIDEO RECORDING: SOME EXPERIMENTS IN ERROR PROTECTION
C. D. Mathers Jan. 1976 10 p refs
(BBC-RD-1976/1) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Two error-protection systems are described which were designed for use with the experimental digital television recorder. The systems were developed as part of a more general investigation into error protection for digital television recording. In the first, concealment of error bursts is controlled by a detection system based on parity bits which constitute 4.8% of the total data rate. In the second system the least significant data bit is sacrificed to make 16.7% of the data capacity available for parity bits; this permits correction of error bursts and concealment of isolated errors. It is concluded that, using the techniques described, acceptable pictures are obtainable with a small ratio of parity bits to data bits, but that a higher ratio than is at present available would be required to prevent perceptible loss of picture quality in multiple-generation recordings. Author

N76-18298*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
DYNAMIC MICROPHONES M-87/AIC AND M-101/AIC AND EARPHONE H-143/AIC
F. H. Reiff May 1975 302 p
(Contract NAS9-12200)
(NASA-CR-147471; LEC-5733) Avail: NTIS HC $9.75 CSCL 17B

The electrical characteristics of the M-87/AIC and M-101/AIC dynamic microphone and H-143 earphones were tested for the purpose of establishing the relative performance levels of units supplied by four vendors. The microphones and earphones were tested for frequency response, sensitivity, linearity, impedance and noise cancellation. Test results are presented and discussed. Author

N76-18299*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TEST PROCEDURES, AN/AIC-27 SYSTEM AND COMPONENT UNITS
F. H. Reiff May 1975 150 p
(Contract NAS9-12200)
(NASA-CR-147472; LEC-5388) Avail: NTIS HC $6.00 CSCL 17B

The AN/AIC-27 (v) intercommunication system is a 30-channel audio distribution which consists of: air crew station units, maintenance station units, and a central control unit. A test procedure for each of the above units and also a test procedure for the system are presented. The intent of the test is to provide data for use in shuttle audio subsystem design. Author

N76-18300*# California Inst. of Tech., Pasadena.
[PROTOTYPE 10-METER RADIO TELESCOPE ANTENNA AND MOUNT DESIGN] Final Technical Report
Robert B. Leighton [1976] 25 p
(Grant NGL-05-002-007)
(NASA-CR-146305) Avail: NTIS HC $3.50 CSCL 17B

A prototype radio antenna of 10.4 meters diameter and 0.41 meter focal length, intended for use at the shortest radio wavelengths transmitted by the atmosphere, was successfully completed. The surface accuracy is at least four times better than that of any existing antenna in this size class: 50 micrometer rms. A prototype mount is being constructed and will be ready by early 1976. The development of an improved antenna of identical size, but heavier weight has been continued. Author

N76-18301*# National Academy of Sciences - National Research Council, Washington, D.C.
USE OF COMMUNICATIONS Practical Applications of Space Systems
1975 55 p refs
(Contract NSR-09-012-106)
(NASA-CR-146403; Paper-2) Avail: NTIS HC $4.50; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 17B

Progress in the field of satellite communications is reviewed, and useful services which may be provided by future satellite communications systems are considered. Recommendations are made with regard to mobile communications for use on land and at sea, position determination, mineral and energy exploration, the possibility of using electronic means to assist in main delivery, education and health-care experiments, and the use of satellite telecommunications to enhance the quality of life in rural areas by making available a full range of educational and entertainment programs. The needs of the amateur radio community are also considered. M.J.S.

N76-18302*# Rockwell International Corp., Anaheim, Calif. Missile Systems Div.
STUDY OF SHUTTLE IMAGING MICROWAVE SYSTEM ANTENNA. VOLUME 1: CONCEPTUAL DESIGN
R. W. Wesley, D. K. Waineo, C. R. Barton, and A. W. Love 21 Nov. 1975 310 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954253)
(NASA-CR-146311; C75-664/034A-Vol-1) Avail: NTIS HC $9.75 CSCL 09F

A detailed preliminary design and complete performance evaluation are presented of an 11-channel large aperture scanning radiometer antenna for the shuttle imaging microwave system (SIMS) program. Provisions for interfacing the antenna with the space shuttle orbiter are presented and discussed. A program plan for hardware development and a rough order of magnitude (ROM) cost are also included. The conceptual design of the antenna is presented. It consists of a four-meter diameter parabolic torus main reflector, which is a graphite/epoxy shell supported by a graphite/epoxy truss. A rotating feed wheel assembly supports six Gregorian subreflectors covering the upper eight frequency channels from 6.6 GHz through 118.7 GHz, and two three-channel prime forms feed assemblies for 0.6, 1.4, and 2.7 GHz. The feed wheel assembly also holds the radiometers and power supplies, and a drive system using a 400 Hz synchronous motor is described. The RF analysis of the antenna is performed using physical optics procedures for both the dual reflector Gregorian concept and the single reflector prime focus concept. A unique aberration correcting feed for 2.7 GHz is analyzed. A structural analysis is also included. The analyses indicate that the antenna will meet system requirements. Author

N76-18303*# Scientific Translation Service, Santa Barbara, Calif.
THE USE OF WRITTEN LANGUAGE TRANSMISSIONS FOR CETI
J. Lehmann Washington NASA Mar. 1976 14 p refs Transl. into ENGLISH from Die Sterne (West Germany), v. 51, no. 2, 1975 p 102-109
(Contract NASw-2791)
(NASA-TT-F-16913) Avail: NTIS HC $3.50 CSCL 17B

A review is presented of communication with extraterrestrial civilizations, using any of the following methods: image transmission, sound transmission, written language transmission. Author

N76-18304*# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.
INVESTIGATIONS OF ELECTROMAGNETIC SCATTERING BY COLUMNAR ICE CRYSTALS Final Report
Herschel Weil and Thomas B. A. Senior 5 Mar. 1976 86 p refs
(Grant NsG-5044)
(NASA-CR-146327; UMICH-013381-1-F) Avail: NTIS HC $5.00 CSCL 20N

An integral equation approach was developed to determine the scattering and absorption of electromagnetic radiation by thin walled cylinders of arbitrary cross-section and refractive index. Based on this method, extensive numerical data was presented at infrared wavelengths for hollow hexagonal cross section cylinders which simulate columnar sheath ice crystals. Author

N76-18305# Australian Post Office Research Labs., Melbourne.
BROADBAND PARAMETRIC AMPLIFIERS FOR SMALL EARTH STATIONS: DESIGN SURVEY
R. K. Flavin Mar. 1975 85 p refs
(Rept-6964) Avail: NTIS HC $5.00

The theory of broadband nondegenerate parametric amplifiers employing a doubly tuned signal circuit is presented. A techno-economic study is performed on several large quantity (1000) paramp designs which predicts the optimum (minimum cost) varactor diode pumped figure of merit and pump frequency as a function of the input noise temperature. Several design considerations for low cost paramps are discussed, and the optimum configurations for three paramps - 2.500 - 2.655 GHz, 3.7 - 4.2 GHz, and 11.7 - 12.2 GHz - are presented. Author

N76-18306# Australian Post Office Research Labs., Melbourne.
DIGITAL TRANSMISSION OVER SINGLE-QUAD CARRIER CABLE
N. Q. Duc Mar. 1975 33 p refs
(Rept-6955) Avail: NTIS HC $4.00

The feasibility of using a single-quad carrier (2/1.27 mm PEIQC) cable as a bearer for second-level PCM transmission at 8.448Mbit/s which also supports 120 circuits was investigated. Two well-known three-level line signals were considered, namely, AMI or bipolar and 4B-3T. In addition, the study was extended to the application of baseband class-4 partial response signalling. The regenerator spacings for various system configurations (one-cable and two-cable transmission) are found to be comparable with or greater than the repeater spacing using in the analogue FDM system. Author

N76-18307# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ANTI-ICING OF ANTENNA SUPPORTS LOCATED ON THE GROSSE ARBER
J. Kedaj [1975] 22 p Transl. into ENGLISH from Fernmelde-Praxis (West Germany), v. 50, no. 2, 1973 p 59-80
(NRC/CNR-TT-1843) Avail: NTIS HC $3.50

The formation of rime ice deposits on antenna supports located on the Grosse Arber is considered. The support structure consists of a spun-concrete mast, rising 37.5 m above ground, on which a steel-tube topping 7.5 m long is mounted, carrying the antenna system for three TV channels. Measures are described to prevent the formation of ice deposits on the antenna support (concrete mast and steel-tube topping), on the covered cable conduit, and on the antennas. The antenna mountings, the cable distributors, and the distributor cables are protected by means of a cylindrical shell. Author

N76-18308# Office of Telecommunications, Boulder, Colo.
EXPERIMENTAL RF FIELD POLARIZATION METER Final Report
R. G. FitzGerrell Washington FAA Nov. 1975 40 p refs
(Contract DOT-FA75WAI-452)
(AD-A019204/7; FAA-RD-75-188) Avail: NTIS HC $4.00 CSCL 20/6

An experimental antenna-receiving system was designed to measure the ratio of vertically to horizontally polarized electromagnetic fields transmitted by VOR/ILS facilities. This field ratio is particularly important because course bearing errors can be caused by modulation carried by some components of the vertically polarized field from VOR facilities. A description is given of the development and testing of a field polarization meter, called a Polariscope by the FAA, to be used for measuring this field ratio. Author

N76-18309# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jul. - 30 Sep. 1975
1 Oct. 1975 61 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; Proj. 034-241-012)
(AD-A019246/8; FAA-RD-75-166) Avail: NTIS HC $4.50 CSCL 17/7

Results obtained to date with the analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the Discrete Address Beacon System (DABS) were reported. Author

N76-18310# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF DISTRIBUTION-FREE QUANTIZER, SEVERAL RANGE BINNING TECHNIQUES, AND AN EXTENDED RANGE MOVING TARGET INDICATOR VIDEO Interim Report, Nov. 1973 - Dec. 1974
Martin Holtz and Leo Wapelhorst Nov. 1975 110 p
(AD-A019337/5; FAA-NA-75-7) Avail: NTIS HC $5.50 CSCL 17/9

Tests were conducted to determine the performance of a radar quantizer having distribution-free characteristics as compared to that of quantizer employing mean level techniques. Several types of range binners were developed and tests were performed to ascertain the false target rate and detection capabilities of each of the quantizer and range binner configurations. Additionally, the performance of the radar processor with inputs derived from

a moving target indicator (MTI) video designed to have an extended dynamic range was investigated. It was concluded that the design of the rank order quantizer approaches theoretical performance. Detection loss is experienced at range cell boundaries. The extended range MTI provides comparable performance to that of MTI log but is far less costly. Additionally, second threshold control is capable of maintaining a false target rate acceptable as an input to a tracking algorithm. Author

N76-18311# Australian Post Office Research Labs., Melbourne.
A 4B-3T ENCODER/DECODER FOR HIGH-SPEED BASE-BAND DIGITAL TRANSMISSION SYSTEMS
A. Y. C. Quan, N. Q. Duc, and A. Domjan Jun. 1975 25 p refs
(Rept-6972) Avail: NTIS HC $3.50

Fundamental properties of a 4B-3T code were presented. A realization of an encoder/decoder suitable for an experimental 140 Mbit/sec. baseband digital transmission system over standard (2.6/9.5 mm) coaxial cable was described. Author

N76-18312# Australian Post Office Research Labs., Melbourne. Psychology Sub-Section.
SUBJECTIVE EVALUATION OF DIGITAL TV ERROR CONCEALMENT TECHNIQUES
R. W. A. Ayre and G. Ardern Mar. 1974 19 p refs
(Rept-6875) Avail: NTIS HC $3.50

A series of subjective viewing tests has been performed to assess the usefulness of line replacement techniques as a means of concealing transmission errors in a DPCM coded television system. Author

N76-18313# Australian Post Office Research Labs., Melbourne.
A GENERAL PURPOSE CABLE IDENTIFICATION SET
R. Wylie Mar. 1974 25 p
(Rept-6854) Avail: NTIS HC $3.50

The General Purpose Cable Identification Set, giving 'interference-less' identification of pairs in a randomly jointed cable, was described. This system uses capacitive coupling of a signal transmitted down the cable pair into a high input-impedance probe to identify the pair. The insulation covering the pair is not pierced in any way. Working at either audible or above-audible frequencies, the set has a long range and performs several other related functions. Author

N76-18314# National Aviation Facilities Experimental Center, Atlantic City, N.J.
LABORATORY MEASUREMENTS OF VERY HIGH FREQUENCY COMMUNICATION EQUIPMENT FOR DATA LINK Interim Report, Oct. 1973 - Oct. 1974
Anthony Swezeny Oct. 1975 211 p
(FAA Proj. 062-222-000)
(AD-A018721/1; FAA-NA-75-5; FAA-RD-75-159) Avail: NTIS HC $5.00 CSCL 17/2

Laboratory measurements were made on very high frequency (VHF) commercial airborne transceivers and Federal Aviation Administration (FAA) VHF ground transmitters and receivers. Characteristics of each unit were measured in order to determine suitability for data link application and to provide a data base for subsequent planning of VHF data link flight tests. Results show that Aeronautical Radio, Inc. (ARINC) transceivers are suitable data link devices and, with minor modifications, most FAA and general aviation transmitters and receivers tested are also suitable at the 2400 and 4800 bit per second rates. Author

N76-18315*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF LOCATING PERSONS IN DISTRESS Patent Application
Wilford E. Sivertson, Jr., inventor (to NASA) Filed 27 Feb. 1976 9 p
(NASA-Case-LAR-11390-1; US-Patent-Appl-SN-662176) Avail: NTIS HC $3.50 CSCL 17B

A method is presented for locating any person in distress in a selected area on the surface of the earth who has deployed passive radio frequency (RF) reflectors in a predetermined arrangement. A first transparency is made in the spatial frequency domain of an image of the predetermined arrangement of the RF reflectors. The selected area of the surface of the earth is scanned by means of a side-looking radar, on board a satellite or aircraft, to produce radar images. Second transparencies in the conventional image domain are produced from the radar images. It is then determined from the first and second transparencies, by means of complex spatial filtering, if RF reflectors in the predetermined arrangement were deployed in the selected area when scanned by the radar. NASA

N76-18316# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 1 Jan. - 31 Mar. 1975
S. N. Cole, E. R. Flynt, and R. C. Michelson Jun. 1975 30 p refs
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A014109; ECOM-74-0272-3; QR-3) Avail: NTIS CSCL 17/9

The report summarizes activities directed toward the design and fabrication of an Environment and Radar Operation Simulator (EROS). The study of clutter simulation continued during the quarter, and decisions have been reached concerning modeling techniques. An implementation model using discrete filters was formulated whose amplitude distribution is described by the Ricean density function and whose power density spectrum can be specified freely. Spatial distribution of clutter in the two horizontal dimensions will be modeled using a cellular-array scenario description. The nonstationarity of clutter is to be simulated by randomly varying the parameters of the filter model. GRA

N76-18317# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
DESIGN TECHNIQUE FOR IMPROVED BANDWIDTH MOVING TARGET INDICATOR PROCESSORS IN SURFACE RADARS
Donald W. Burlage and Ronald C. Houts 11 Jun. 1975 73 p refs
(DA Proj. 1M2-62303-A-2)
(AD-A014151; RE-75-35) Avail: NTIS CSCL 17/9

A technique is presented for assigning the number and values of a set of transversal digital filter weights used with a moving target indicator filter to remove clutter. The approach involves a tradeoff between the amount of clutter rejection and useable bandwidth over which a moving target indicator filter satisfactorily passes a Doppler signal; i.e., a specified detection probability is met or exceeded. The useable bandwidth is enhanced by an integrator which sums the B outputs from an N-tap, fixed window moving target indicator filter during a beam dwell of NB pulses. The procedure is applicable to any moving target indicator radar which employs a transversal moving target indicatory filter and a reasonable number of returns/beam dwell. The narrow-band clutter example indicates an improvement in useable bandwidth from the 62 percent achievable with 16 outputs from a conventional three-pulse canceller to 80.8 percent for five outputs from a nine-tap Chebyshev filter, while only reducing the clutter rejection from 92 to 69 db. Listings for computer programs used in the design and analysis are included. GRA

N76-18318# Parke Mathematical Labs., Inc., Carlisle, Mass.
IMPLEMENTS AND TECHNIQUES FOR THE ANALYSIS OF RADIO PROPAGATION THROUGH THE ARCTIC IONOSPHERE USING THREE-DIMENSIONAL RAY TRACING Final Report, Jul. 1973 - Jun. 1975
Barbara M. Langworthy and Theodore B. Barrett Jun. 1975 331 p refs
(Contract F19628-73-C-0307; AF Proj. 7663)
(AD-A016757; AFCRL-TR-75-0319) Avail: NTIS CSCL 17/2

The report describes work done in three-dimensional ray tracing through the arctic ionosphere. An analytical model of the polar trough was developed using data collected or analyzed by AFCRL-LIB. Improved methods for using measurements of plasma frequency in the ray tracing program were effected. A series of display programs were written for the CDC 6600 using ray paths produced by the ray tracing program. A method for calculating energy density to compare with model calculations was developed. The report includes a case study for the mean polar ionosphere using a transmission of 5 MHz. Results for other frequencies as well as other polar models are included in

Appendix L. Computer program documentation for all programs and special subroutines developed under this contract are included in the appendices. GRA

N76-18319# Bazovsky (Igor) and Associates, Inc., Tarzana, Calif.
AFSATCOM TERMINAL NO. 3 RELIABILITY IMPROVEMENT STUDY Final Report
Los Angeles AF Station Calif. SAMSO 30 Oct. 1975 199 p (Contract F04701-75-C-0020)
(AD-A016762; SAMSO-TR-75-242) Avail: NTIS CSCL 17/2

A sample of SRU's from AFSATCOM Terminal No. 3 are analyzed from a predicted hardware reliability viewpoint. Top reliability problems are noted and design change recommendations are made to improve the predicted hardware reliability first computed. These improvements are linked to life cycle costs to determine their cost effectiveness. Other reliability problems not directly related to life cycle costs are also discussed. GRA

N76-18320# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
SOME CONSIDERATIONS ON TARGETS FOR RADAR GUIDED AIR DEFENSE SYSTEMS
James W. Wright 15 Sep. 1975 20 p refs
(DA Proj. 1M3-63307-D-238)
(AD-A016881; RE-76-10) Avail: NTIS CSCL 17/9

The purpose of this report is to present some considerations which may affect the design and/or selection of test targets for radar guided air defense systems. The primary consideration is the dynamic radar signature presented by the target. This report is generally of a qualitative nature and is intended to be a tutorial exposition of problems. Recommendations on research efforts to fill in some data gaps are made. Author (GRA)

N76-18321# National Bureau of Standards, Washington, D.C. Operations Research Section.
MATHEMATICAL METHODS OF SITE SELECTION FOR ELECTRONIC MESSAGE SYSTEMS (EMS) Final Report
Cristoph Witzgall Jun. 1975 45 p refs Sponsored in part by the Postal Service
(COM-75-11472/8; NBSIR-75-737) Avail: NTIS HC $4.00 CSCL 17B

The concept of electronic message (mail) transmission was the subject of several feasibility studies during the past decade. It requires the installation of electronic message handling facilities at selected locations. If transmission is to be via communications satellite, then any such facility can transmit to and receive from any other one. In the report, the mathematical aspects of choosing the number and locations of these facilities are examined. An inventory of solution methods is presented, along with recommendations as to which among them should be employed or developed further. GRA

N76-18322# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
BENEFIT-COST ANALYSIS FOR DISASTER WARNING SYSTEMS, SUMMARY REPORT
Steven O. Rosen and Yacov Y. Haimes Jan. 1975 22 p refs (Contract COM-OT-0110)
(COM-75-11449/6; SED/WRG-75/1) Avail: NTIS HC $6.75 CSCL 13L

Natural disasters such as floods, hurricanes, and tornadoes threaten the United States each year. Consequently, disaster warning systems can play an important role in mitigating their potential effects. An analytical framework is developed for analyzing the costs and benefits of home warning systems, the costs being measured in terms of present value dollars, while the noncommensurable benefits are measured by both total lives saved and present value dollars (property damage avoided). GRA

N76-18323# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
BENEFIT-COST ANALYSIS FOR DISASTER HOME WARNING SYSTEMS, (ANNEX TO SUMMARY REPORT)
Steven O. Rosen and Yacov Y. Haimes Jan. 1975 203 p refs
(Contract COM-OT-0110)
(COM-75-11450/4; SED/WRG-74/6) Avail: NTIS HC $7.75 CSCL 13L
For abstract, see N76-18323.

N76-18324# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DAASM PROJECT-HIGH LATITUDE AIRCRAFT HF PROPAGATION EXPERIMENT
Gary S. Sales, John I. Videberg, and Rajan Varad 19 May 1975 104 p refs
(AD-A015764; AFCRL-TR-75-0290; AFCRL-ERP-516) Avail: NTIS CSCL 17/9

The purpose of the DAASM project is to investigate the effects and limitations caused by the auroral and polar ionosphere on over-the-horizon HF propagation using a backscatter sounding system. The technique measures and records the complex amplitude of incoming, forward or backscatter signals, including noise, at each of the 12 elements of a broadside antenna array. The data is subsequently processed using sophisticated software on a CDC-6600 computer at AFCRL. This process, using Fourier analysis techniques, provides output in the form of Doppler frequency vs arrival-angle maps as well as coherence maps. GRA

N76-18325# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEETING OF THE NATO AC/258 EED SUBGROUP
F. Cantrell 7 May 1975 22 p refs Transl. into ENGLISH from the bool "Direction des Constructions et Armes Navales" Toulon, 24 Feb. 1975 p 1-9 (Original in Russian) In SWAHILI Meeting held at Toulon, USSR, 25-27 Feb. 1975
(AD-A016139; FTD-HC-23-1144-75) Avail: NTIS CSCL 19/1

The responses of munitions containing electropyrotechnic devices (DEP's) are discussed. The level of electromagnetic environments acceptable for munition was determined, and the safe distance between the antenna and the munition or DEP is computed. M.J.S.

N76-18326# Army Electronics Command, Fort Monmouth, N.J.
TACTICAL FIELD DEMONSTRATION OF MOBILE WEATHER RADAR SET AN/TPS-41 AT FORT RUCKER, ALABAMA
Raymond L. Robbiani Aug. 1975 30 p refs
(DA Proj. 1S7-674726-D-511)
(AD-A016164; ECOM-5572) Avail: NTIS CSCL 17/9

The purpose of this report is to describe the data collected by Radar Set AN/TPS-41 during a tactical field demonstration at the U.S. Army Aviation Center, Fort Rucker, Alabama. The prime objective was to demonstrate the capability of the weather radar to support forward area airfield operations in conjunction with only that meteorological data normally provided under tactical deployment. The secondary objective was to demonstrate the mobility, rapid setup, and remote unit flexibility of the system's configuration while satisfying the requirements of a forward area weather radar system. GRA

N76-18327# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE ARIES PROGRAM: COORDINATES, TRANSFORMATIONS, TRAJECTORIES AND TRACKING
Bliss L. Diamond and Michael E. Austin 5 Sep. 1975 99 p refs
(Contract F19628-76-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A015815; ESD-TR-75-255) Avail: NTIS CSCL 17/9

This report presents the relations necessary to define the motion of a target in the gravitational field of the earth. In order to express this target motion in the frame of a radar, an appropriate set of coordinate systems (and transformations) is introduced. Target tracking in the form of a Maximum Likelihood Estimator is discussed. The problem of interceptor miss distance is treated from the standpoint of the uncertainty volumes associated with estimated target state vectors. GRA

N76-18328# Naval Academy, Annapolis, Md.
ADVANCE IDENTIFICATION OF CATASTROPHIC TRAFFIC BUILD-UP IN THE NAVAL TELECOMMUNICATION COMMAND
Louis T. Roumaya 2 Jun. 1975 110 p refs
(AD-A015960; USNA-TSPR-73) Avail: NTIS CSCL 17/2

The Naval Telecommunication Command (NAVTELCOM) carries out for the Chief of Naval Operations, The Dept. of Navy's

responsibilities for defense telecommunications. A fundamental problem with the Fleet Broadcast occurs because the new Automated Broadcast Stations can receive and process message faster than the ships of the fleet can receive them. Message backlogs result and corrective measures must be taken. The thrust of this project was an analysis of the various measures to prevent and deal with backlogs occuring in these stations. It focused on the Navy's Automated Communications Station at Norfolk, which is the model for four other systems around the world. Their operation of the Fleet Broadcast was studied and modeled. To evaluate the impact of the proposed changes and other possible changes a computer program for simulating the operation of the Fleet Broadcast was prepared for use on the Naval Academy's Computer System and it is discussed in Appendix B., and listing of the program is included. The report suggests several early implementable changes in the way the broadcast is managed - to improve its operation. Author (GRA)

N76-18329# Naval Research Lab., Washington, D.C.
FINE SYNCHRONIZATION OF COHERENT FREQUENCY HOPPING SIGNALS Final Report
A. F. Thornhill Oct. 1975 25 p refs
(NRL Proj. R01-45; WF21222602)
(AD-A015939; NRL-MR-3137) Avail: NTIS CSCL 17/2

A method for precise synchronization of receiver timing with a phase coherent frequency hopping signal has been developed. It is assumed that initial synchronization by other techniques has aligned the receiver frequency hopping sequence with the signal well enough so that the receiver operates on the same frequency as the signal for most of each hop period. Phase comparisons between the signal and a locally generated replica then can be made and summed over a large number of frequency hops to provide a sensitive measure of the remaining synchronization error. Frequency dependent errors in the phasing of quadrature channels in the experimental synchronizer produced ripple in the detector output. Additional ripple was produced by circuits used for combining the quadrature channel outputs. The observed ripple produced reversals in the slope of the error signal, and, in a complete system, would have led to limited instability of synchronization. Criteria have been developed for determining circuit characteristics necessary to reduce the ripple to an acceptable value. The effects on the synchronization method of frequency offsets and of several modulation types have been examined, and techniques have been proposed for maintaining close synchronization in the presence of these effects. GRA

N76-18330# New Mexico State Univ., University Park. Engineering Experiment Station.
USE OF WAVE PERIOD IN SIGNAL DETECTION, PART 3 Final Report, 14 Jan. 1974 - 13 Jan. 1975
Lonnie C. Ludeman and Shun-Hon Chung 1 Jul. 1975 32 p refs
(Contract DAHC04-74-G-0084)
(AD-A015711; ARO-11422.4-A-Pt-3) Avail: NTIS CSCL 17/9

An optimum receiver, wave period processor, is derived using pulse width statistical information only. Because of its complexity a suboptimum receiver, a coincidence detector, using independent samples of the wave periods is described. The performance in the form of the receiver operating characteristics of this suboptimum receiver is given for the special case of pure sinusoid plus bond-limited white Gaussian noise. GRA

N76-18331# Semcor, Inc., Riverdale, Md.
THE USE OF FREQUENCY AGILITY TO ACHIEVE HIGH PROBABILITY OF TARGET DETECTION ON A SINGLE RADAR SCAN
Wayne Rivers 1 Aug. 1975 29 p refs
(Contract N00024-74-C-1028)
(AD-A016275; SD-75213-1) Avail: NTIS CSCL 17/9

To achieve high probability of detection on a single scan, noncoherent integration of video signals can be more efficient than coherent integration if frequency agility is used to decorrelate the radar return pulse-to-pulse from a slowly fluctuating target. For a required detection probability of 0.9, the potential advantage from noncoherent integration of frequency-agile returns, as compared to coherent integration of the same total pulse energy on a single frequency, is about 5 db for Swerling Case I-II targets and 2 db for Case III-IV targets. The potential advantage is greater when higher detection probabilities are required. A strategy usable for both Swerling Case I-II and III-IV targets and P sub D values of 0.9 to 0.99 is indicated in which the burden of coherent and noncoherent integration is partitioned during the available dwell so that the number of statistically independent samples integrated after envelope detection is between 9 and 14. GRA

N76-18332# Hughes Aircraft Co., Culver City, Calif. Antenna Dept.
HEMISPHERICALLY SCANNED ANTENNAS Final Report, Dec. 1971 - Mar. 1975
Alfred T. Villeneuve, Nicolas G. Alexopoulos, and Wolfgang Kummer May 1975 44 p refs
(Contract F19628-72-C-0145; AF Proj. 4600)
(AD-A015766; HAC-Ref-C5350-F; AFCRL-TR-75-0294) Avail: NTIS CSCL 09/5

The report contains the results of a study of techniques for obtaining extended coverage element patterns for use on hemispherically scanned phased arrays on cylinders of large radius of curvature. It contains experimental patterns of slot radiators on such a cylinder covered with surface wave structures. Experimental patterns of slots coupled to parasitic dipoles extended around the cylinder are also included. An analysis that treats sources on reactive cylinders is performed to determine what type of surfaces will give extended coverage when the polarization is parallel to the cylinder axis. The results of the study indicate that improved coverage can be obtained using reactive surfaces that are selected to affect TE waves and TM waves in different manners. Such surfaces can be constructed by combining corrugated conductors and dielectric slabs. The combination can be selected to provide effectively the proper surface reactance to allow radiation near the horizon for both polarizations. GRA

N76-18333# Naval Research Lab., Washington, D.C.
CRYOGENIC LOOP ANTENNAS FOR VLF RECEPTION IN SEAWATER Interim Report
David L. Guerrino 24 Sep. 1975 28 p refs
(NRL Proj. R01-09; XF21222702)
(AD-A016181; NRL-7901) Avail: NTIS CSCL 09/5

The signal-to-noise ratio used to receive VLF transmissions will improve as the antenna temperature is lowered, even when the antenna is enclosed in an insulating radome and submerged in seawater. Noise (or losses) coupled into the antenna from the seawater will limit the improvement if the received atmospheric noise is small compared to the coupled sea noise. The coupled losses can be reduced by increasing the size of the radome. The loop does not have to be superconducting to achieve important gains in its signal-to-noise ratio. Several small 16-gauge copper wire loops were analyzed. Calculations showed that the signal-to-noise ratio of a 5.08-cm-diameter, untuned, single-turn loop, enclosed in a 30.48-cm-diameter radome and submerged in 4-mho/m water, will improve by a factor of about 104(40 db) as the temperature of the antenna is lowered from 295 K to 20 K. The calculation was made at 20 kHz, and the noise level was assumed to be established by the real part of the antenna impedance. The signal level was held constant. A preamplifier using a superconducting quantum interference device (SQUID) appears to be the best suited for use with a small cryogenic loop antenna. GRA

N76-18334# RAND Corp., Santa Monica, Calif.
A LITTLE-KNOWN EFFECT OF ANTENNA SIZE ON SIGNAL WAVEFORM Interim Report
T. F. Burke Aug. 1975 45 p
(Contract F44620-73-C-0011)
(AD-A015836; R-1819-PR) Avail: NTIS CSCL 09/5

A review is given of the usual approximate solution of the calculation of the radiation field of an aperture to demonstrate an attribute of the solution which is widely overlooked and which describes a little-understood feature of the radiation field. The report presents a simple theoretical analysis of the phenomena associated with most antennas and shows representative examples of waveform distortion resulting from antenna effects. GRA

N76-18335# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.

DESIGN OF REACTIVELY CONTROLLED ANTENNA ARRAYS

Roger F. Harrington, Robert F. Wallenberg, and Alan R. Harvey Sep. 1975 46 p refs

(Contract N00014-67-A-0378-0006; NR Proj. 371-885)

(AD-A015675; TR-4; TR-75-10) Avail: NTIS CSCL 09/5

This report considers the use of variable reactance loads to control the beam direction of reactively loaded antenna arrays. The arrays considered have a single feed point, no transmission lines to the elements, and one reactive load per element. Only partial control of the array characteristics is possible using this scheme. The initial design of the array is obtained by resonating the desired port currents, and this is then improved by an optimum seeking univariate search method. This procedure gives good results for arrays of moderate numbers of relatively closely spaced elements. Several numerical examples are given for arrays of half-wavelength long dipole antennas. A computer program for the univariate search method, with operating instructions, is included. Author (GRA)

N76-18336# Wisconsin Univ., Madison. Mathematics Research Center.

AN INVERSE SCATTERING TRANSFORM FOR WAVE-WAVE SCATTERING Technical Summary Report

Flora Y. F. Chu and Alwyn C. Scott Jun. 1975 24 p refs

(Contract DA-31-124-ARO(D)-462; Grant NSF GK-3755)

(AD-A016102; MRC-TSR-1524) Avail: NTIS CSCL 20/14

An inverse scattering transform method is outlined for the resonant interaction of two plane waves (an incident wave of amplitude (A sub 1) and radian frequency (Omega sub 1) and a scattered wave of amplitude (A sub 2) and frequency (Omega sub 2) with a medium which can propagate classical scattering waves (of amplitude Y and frequency (Omega sub 3). The inverse scattering transform method can be viewed as a nonlinear generalization of the Fourier transform method, and, in the form presented here, it describes the dynamics of the scattering medium Y(x,t). The results can be applied to a variety of physical problems including: (1) Raman and Brillouin scattering of laser light, (2) electromagnetic wave-wave interactions in a plasma, and (3) the distributed parametric amplifier. GRA

N76-18337# Harry Diamond Labs., Adelphi, Md.

TECHNIQUE FOR ABSOLUTE MEASUREMENT OF NOISE POWER AT ALL RADIO FREQUENCIES

Abraham Singer and Jan M. Minkowski Mar. 1975 31 p refs

(HDL Proj. 797G78; HDL Proj. A10376)

(AD-A016167; HDL-TR-1671) Avail: NTIS CSCL 20/14

A method and system for absolute measurement of noise power is described. The method is valid at all radio frequencies but is particularly useful above 65 GHz where no other means for making such measurements currently exists. In addition, it has the important advantages of relative simplicity and reliability. GRA

N76-18338# Air Force Weapons Lab., Kirtland AFB, N.Mex.

THE TREATMENT OF ELECTRON SCATTERING AND APPROXIMATE METHODS USED FOR SPECIFYING HIGH-ALTITUDE EMP SOURCES Final Report, Jul. 1973 - Dec. 1974

John F. Morgan and Gary R. Knutson Apr. 1975 31 p refs

(AF Proj. 133B; DNA Proj. NWED-QAXE A091)

(AD-A015747; AFWL-TR-74-341) Avail: NTIS CSCL 20/8

A Monte Carlo electron transport code was used to calculate the EMP sources produced (1) by monoenergetic electrons, (2) by a Compton scatter distribution of electrons, and (3) by a photoelectric scatter distribution of electrons. The effects of nuclear-coulomb electron scattering, of the continuous slowing down method of electron energy loss, and of electron turning in the geomagnetic field of the earth were included in the calculations. Analytic results were obtained from the source routine of AFWL one-dimensional high-altitude EMP code, HEMP B. Sources include an improved slowing down model and the option of two electron scatter approximations based on small angle scatter theory; one based on an average obiquity of the distribution, and the other based on a random selection of scattering direction. The Monte Carlo results are compared to the analytic methods for a delta function source of photons. Author (GRA)

N76-18339# BDM Corp., Albuquerque, N.Mex.

SOLUTION OF THIN-WIRE MOMENTS PROBLEMS BY BANDED MATRIX ITERATION Quarterly Technical Report, 2 Jan. - 1 Apr. 1975

T. R. Ferguson Jul. 1975 100 p refs

(Contract F30602-74-C-0182; AF Proj. 4540)

(AD-A015826; BDM/A-50-75-TR; RADC-TR-75-189; QTR-4) Avail: NTIS CSCL 20/14

An extensive number of examples where banded matrix iteration techniques were used as the solution algorithm in the method of moments are presented. The antenna examples solved using the banded matrix solution technique include: helix, rhombic, long crossed wires, parallel wires, collinear wires, linear array dipoles, circular array dipoles and wire grids. Preliminary guides for segment numbering as used in the banded matrix technique are also presented. GRA

N76-18340# Naval Underwater Systems Center, New London, Conn. Sonar Technology Dept.

ROBUST SEQUENTIAL PROBABILITY RATIO DETECTORS

Joseph J. Wolcin, III 11 Sep. 1975 182 p refs

(AD-A015637; NUSC-TR-5223) Avail: NTIS CSCL 09/4

A statistical hypothesis test is developed for situations in which uncertainty exists in the underlying probability distributions of the observations. The resulting test, called the robust sequential probability ratio test (RSPRT), provides a theoretical framework within which specific detection problems can be formulated. As the name implies, the RSPRT is sequential in nature, and it guarantees a given performance level (in terms of error probabilities). Application of the RSPRT requires the definition of disjoint classes of distributions which contain the distribution of the observations under each respective hypothesis, the determination of 'least favorable' sequences of distributions. The likelihood ratio between these sequences forms the basic structure of the test. The RSPRT is applied to two models of uncertainty which frequently arise in practice. In the first, the distribution of the observations under each hypothesis is known to lie in the neighborhood of some known nominal distribution, but the exact distributional form is unknown. In the second model, the observations have known univariate Gaussian distributions, but compositeness of the hypotheses results because of uncertain correlation between the observations. In each case the performance measures of the test are examined in detail. The RSPRT is shown to be far superior to a fixed sample size robust test in terms of expected observation length. GRA

N76-18341# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.

HIGH SPEED CONVOLUTION OF PERIODIC FUNCTIONS

R. S. Bucy, A. J. Mallinckrodt, and H. Yousself 1975 14 p refs

(Grants AF-AFOSR-2141-71; NSF OIP-74-20601; AF Proj. 9769)

(AD-A015926; AFOSR-75-1349TR) Avail: NTIS CSCL 09/4

An approximate homomorphism between the Banach Algebras of periodic functions of one variable and that of periodic functions of two variables is studied. Application to device synthesis of nonlinear filters is indicated. GRA

N76-18342# Raytheon Co., Waltham, Mass. Research Div.

HIGH-EFFICIENCY SOLID-STATE C-BAND GENERATOR Interim Report, 24 Jun. - 24 Dec. 1974

R. N. Wallace Jul. 1975 85 p refs

(Contract F30602-74-C-0306; AF Proj. 5573)

(AD-A015757; S-1814; RADC-TR-75-176) Avail: NTIS CSCL 09/5

Progress toward the development of a 10 W CW 5 GHz generator having more than 25 percent efficiency and capable of being combined with similar units to produce 50 W output is described. To date, four-mesa GaAs Read IMPATT diodes with up to 8.6 W CW output and 20.7 percent efficiency at 5.15 GHz have been demonstrated. Efficiencies up to 28 percent and power outputs up to 4.4 W CW in the 5 GHz range have been obtained from single-mesa devices. A 10 W diode at 5 GHz appears feasible. A cavity-type power-combining circuit capable

of accommodating six such diodes is under construction and will be tested during the second half of the program. GRA

N76-18343# Mitre Corp., Bedford, Mass.
CHARACTERIZATION AND MODELING OF THE DIGITAL HIGH-SPEED AUTOVON CHANNEL Interim Report
Kenneth Brayer Aug. 1975 59 p refs
(Contract F19628-73-C-0001; AF Proj. 6190)
(AD-A015862; MTR-2802; ESD-TR-75-79) Avail: NTIS CSCL 17/2

An interim analysis of error pattern data collected at 4800 b/s and 9600 b/s via digital data transmission on AUTOVON using the Codex 9600 modem has been performed. The data tends to show that errors occur in dense bursts, ranging in length to thousands of bits with significant numbers of bursts of a few hundred bits length. The bursts are generally separated by long error-free intervals. The differences between the 4800 b/s and 9600 b/s data appear to be minimal with fewer bursts at 9600 b/s. No conclusions should be drawn in terms of a 4800 vs 9600 b/s comparison since the data considered in this interim report was not balanced in terms of numbers of bits collected at the different data rates or the different selected switch connections. When equal amounts of data are available for the various switch configurations it should then be possible to compare 4800 and 9600 b/s data. It has been demonstrated that an analytical channel model can be fit to the data, namely a MARKOV channel model. This model can be used for coding analysis by those who do not have the raw channel data and data analysis programs. Author (GRA)

N76-18344# Stein Associates, Inc., Waltham, Mass.
DELTA MODULATION DIGITAL FILTERING TECHNIQUES Final Technical Report, 8 Mar. - 8 Nov. 1974
Howard E. Nichols, Roy M. Westerberg, and James M. Aufiero Sep. 1975 307 p refs
(Contract F30602-74-C-0179; AF Proj. 4519)
(AD-A015827; RADC-TR-75-158; Rept-6035-11) Avail: NTIS CSCL 17/2

The effort has demonstrated the feasibility and practicality of several computationally efficient procedures for simplifying the digital processing of Delta Modulation encoded signals. Design techniques for transversal filters having tap weights quantized to one bit were developed and evaluated. Techniques for direct conversion of CVSD encoded signals to PCM were developed and implemented on a 16-bit fixed-point programmable processor providing realtime computation. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-18345* National Aeronautics and Space Administration. Pasadena Office, Calif.
ANALOG TO DIGITAL CONVERTER Patent
Charles H. Lucas, inventor (to NASA) Issued 10 Feb. 1976 11 p Filed 27 Aug. 1974 Supersedes N74-32646 (12 - 22, p 2663) Sponsored by NASA
(NASA-Case-NPO-13385-1; US-Patent-3,938,188; US-Patent-Appl-SN-501011; US-Patent-Class-340-347AD) Avail: US Patent Office CSCL 09C

An analog-to-digital converter, finding particular application in a multichannel pulse height analyzer, includes means for digitizing the analog input in two conversion steps. To digitize the input to 13 bits, a 7-bit digital to analog converter with a 7-bit up-down counter is used. During the first conversion step which is a coarse conversion, the input V sub i is compared with the DAC output, V sub I and the 7-bits of the counter are set by successive approximation. Thereafter the DAC output is driven twice toward V sub i. The output of an amplifier is stored after each change of the DAC in one of two storage and hold circuits, depending on the polarity of the amplifier output. Then, the content of the 7-bit counter is transferred to the 7 higher order bits of a 14-bit buffer counter. The fine conversion step is performed by successive approximation.
Official Gazette of the U.S. Patent Office

N76-18346*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND PERFORMANCE VERIFICATION OF ADVANCED MULTISTAGE DEPRESSED COLLECTORS
H. Kosmahl and P. Ramins [1975] 12 p refs Presented at the Intern. Electron Devices Meeting, Washington, D. C., 1-3 Dec. 1975; sponsored by IEEE Sponsored in part by AF
(NASA-TM-X-71858) Avail: NTIS HC $3.50 CSCL 09A

Design and performance of a small size, 4 stage depressed collector are discussed. The collector and a spent beam refocusing section preceding it are intended for efficiency enhancement of octave bandwidth, high CW power traveling wave tubes for use in ECM. Author

N76-18347*# Southwest Research Inst., San Antonio, Tex.
ELECTRICAL TERMINATION TECHNIQUES Final Report
W. E. Oakey and R. R. Schleicher Jan. 1976 119 p refs Original contains color illustration
(Contract NAS9-13890; SwRI Proj. 16-3905)
(NASA-CR-147460) Avail: NTIS HC $5.50 CSCL 09C

A technical review of high reliability electrical terminations for electronic equipment was made. Seven techniques were selected from this review for further investigation, experimental work, and preliminary testing. From the preliminary test results, four techniques were selected for final testing and evaluation. These four were: (1) induction soldering, (2) wire wrap, (3) percussive arc welding, and (4) resistance welding. Of these four, induction soldering was selected as the best technique in terms of minimizing operator errors, controlling temperature and time, minimizing joint contamination, and ultimately producing a reliable, uniform, and reusable electrical termination.
Dissert. Abstr.

N76-18348*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLID STATE REMOTE POWER CONTROLLERS FOR 120 Vdc POWER SYSTEMS
G. R. Sundberg and D. E. Baker (Westinghouse Electric Corp., Lima, Ohio) 1976 19 p refs To be presented at the 24th Ann. Natl. Relay Conf., Stillwater, Okla., 27-28 Apr. 1976; Sponsored by Okla. State Univ.
(NASA-TM-X-71874) Avail: NTIS HC $3.50 CSCL 09C

Solid state Remote Power Controllers (RPCs) developed for use in any dc power system with voltage up to 120 Vdc and distributed power up to 3.6 kW per bus are described. The RPCs were demonstrated to be reliable, 99 percent efficient, comparatively simple, and potentially low in cost. Advantages of the RPCs include: contactless switching; controlled rates of current rise and fall; current limiting; and fast, well-defined, repeatable response to overloads and faults. Author

N76-18349*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
LSI ARRAYS FOR SPACE STATIONS Interim Report
J. D. Gassaway Feb. 1976 48 p refs
(Contract NAS8-26749)
(NASA-CR-144166; EIRS-EE-73-2) Avail: NTIS HC $4.00 CSCL 09C

Two approaches have been taken to study CCD's and some of their fundamental limitations. First a numerical analysis approach has been developed to solve the coupled transport and Poisson's equation for a thorough analysis of charge transfer in a CCD structure. The approach is formulated by treating the minority carriers as a surface distribution at the Si-SiO2 interface and setting up coupled difference equations for the charge and the potential. The SOR method is proposed for solving the two dimensional Poisson's equation for the potential. Methods are suggested for handling the discontinuities to improve convergence. Second, CCD shift registers were fabricated with parameters which should allow complete charge transfer independent of the transfer electrode gap width. A test instrument was designed and

constructed which can be used to test this, or any similar, three phase CCD shift register. Author

N76-18350*# Litton Industries, San Carlos, Calif. Electron Tube Div.
DEVELOPMENT OF A HIGH POWER 12GHz PPM FOCUSED TRAVELING WAVE TUBE Final Report
Richard Lewis May 1975 89 p refs
(Contract NAS3-14391)
(NASA-CR-134856) Avail: NTIS HC $5.00 CSCL 09A

An analytical and experimental program to demonstrate the technical feasibility of a high efficiency coupled cavity traveling wave tube with periodic permanent magnetic focusing operating at 12.06 GHz, with 1 to 2 kilowatts CW power is described. Such a tube would ultimately be used for broadcasting power transmission from a satellite. The electron gun was designed to be demountable with a replaceable cathode, and the tube to be operable in a bakeable vacuum chamber with its collector replaced by a collector. Therefore, the high efficiency design was concerned with the slow wave structure only, utilizing velocity resynchronization. A special adapter was designed which incorporated an electromagnet refocusing section and a collector baseplate to facilitate testing the collector. CW output power of 1000 watts yielding 21.5% electronic efficiency was demonstrated, with a minimum output power of 525 watts across the specified 160 MHz bandwidth. Author

N76-18351*# Hughes Aircraft Co., Culver City, Calif. Systems Group.
TECHNOLOGICAL DEVELOPMENT OF HIGH ENERGY DENSITY CAPACITORS Final Technical Report
Robert D. Parker Feb. 1976 126 p
(Contract NAS3-18925)
(NASA-CR-124926; P75-477) Avail: NTIS HC $6.00 CSCL 09A

A study was conducted to develop cylindrical wound metallized film capacitors rated 2 micron F 500 VDC that had energy densities greater than 0.1J/g. Polysulfone (PS) and polyvinylidene (PVF2) were selected as dielectrics. Single film PS capacitors of 0.2J/g (uncased) were made of 3.75 micron material. Single film PVF2 capacitors of 0.19J/g (uncased) were made of 6.0 micron material. Corona measurements were made at room temperature, and capacitance and dissipation factor measurements were made over the ranges 25 C to 125 C and 120 Hz to 100 kHz. Nineteen of twenty PVF2 components survived a 2500 hour dc plus ac life test. Failure analyses revealed most failures occurred at wrinkles, but some edge failures were also seen. A 0.989g case was designed. When the case was combined with the PVF2 component, a finished energy density of 0.11J/g was achieved. Author

N76-18352# Australian Post Office Research Labs., Melbourne.
TIME DELAY CUT-OUT FOR BATTERY OPERATED EQUIPMENT
R. Wylie Feb. 1973 16 p
(Rept-6738) Avail: NTIS HC $3.50

The time delay cut-out which solves the battery life problems of some battery operated instruments is described. Drawing a very small current of its own (less than 2 micro amps), it causes no further load on the batteries. However, there is a serious voltage drop associated with the switching device and certain supply configuration limitations presently limit the application of the cut-out. Author

N76-18353* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC CHARACTER SKEW AND SPACING CHECKING NETWORK Patents
Robert T. McKenna, inventor (to NASA) 10 Feb. 1976 8 p Filed 6 Jan. 1975 Supersedes N75-16792 (13 - 08, p 0884)
(NASA-Case-GSC-11925-1; US-Patent-3,938,182; US-Patent-Appl-SN-538983; US-Patent-Class-360-26; US-Patent-Class-360-51) Avail: US Patent Office CSCL 09C

A network is disclosed for automatically checking the skew and character spacing of digital tape drive systems to indicate out-of-tolerance conditions of those parameters. The network enables a tape drive to check its own recording accuracy as well as that of tapes recorded on other drives. In operation, the first detected pulse of each character triggers a monostable multi-vibrator which locks out further data pulses and initiates a window pulse equal in length to the maximum permissible skew. At the end of the window pulse data pulses may again be received. If a pulse is received after termination of the window pulse, the skew is determined to exceed specifications and a skew error indication is given by the illumination of display light. A similar circuit arrangement is provided for detecting character spacing which is less than the minimum required for unambiguous data reproduction. Official Gazette of the U.S. Patent Office

N76-18354# Silicon Transistor Corp., Chelmsford, Mass.
PRODUCTION ENGINEERING MEASURE FOR HIGH CURRENT, FAST-SWITCHING TRANSISTORS Final Report, 19 Jan. - 19 Jul. 1975
19 Jul. 1975 164 p
(Contract DAAB05-73-C-2032)
(AD-A015581) Avail: NTIS CSCL 09/1

The initial design considerations that led to the choice of a multiple epitaxial fabrication process and a hard-solder construction technique are discussed. The pilot capability was demonstrated by the fabrication of 163 transistors during the calendar month of April 1975. The electrical parameters of the 120 transistors that were shipped and details of the Lot Acceptance Testing are presented in the Lot Acceptance Test Report. GRA

N76-18355# Naval Ship Research and Development Center, Annapolis, Md.
SWITCHGEAR INVESTIGATIONS FOR A 400-hp dc SUPERCONDUCTIVE PROPULSION SYSTEM
D. B. Steen Aug. 1975 57 p
(Proj. S4658)
(AD-A014872; NSRDC-4436) Avail: NTIS CSCL 13/10

The report describes candidate switchgear for the electrical power circuit of a 400-horsepower ship propulsion system utilizing superconductive direct-current machinery. The switchgear comprises an intermittent duty rheostat, five single-pole single-throw contactors, current limiting fuses, and a controller which provides the proper sequencing of the various switchgear components for shipboard propulsion system control. The salient features of propulsion systems employing acyclic motors and generators are discussed, and the characteristics of several types of switchgear are examined to indicate the reasons for the selection of switchgear to be used in the 400-horsepower propulsion system. Detail designs for the fluid-displacement, liquid-metal contactor, the intermittent duty rheostat, and the controller will appear in future reports. GRA

N76-18356# Illinois Univ., Urbana.
COMPUTER AIDED ANALYSIS OF INTEGRATED INJECTION LOGIC
Jeffrey Alan Niehaus Sep. 1975 47 p refs
(Contract DAAB07-72-C-0259)
(AD-A015808; UILU-ENG-75-2224; R-689) Avail: NTIS CSCL 09/5

Integrated injection logic is a low power, high density bipolar logic family. The switching speed is inversely proportional to the current levels used, which can vary anywhere from the nA to microamp range. Since integrated injection logic is a current switching logic, it can operate over a wide range of supply voltages. Besides possessing a low speed power product, it has the highest packing density of any standard logic family. The paper compares results of derived equations with circuit simulations run under the Berkeley SPICE program on the DEC-10 Computer. Logic design with these multiple-output, single-input devices is also analyzed and simulated on the computer. GRA

N76-18357# General Electric Co., Utica, N.Y. Aerospace Electronic Systems Dept.
EVALUATION OF LEAD FINISHES FOR MICROCIRCUIT PACKAGES Final Technical Report, 23 Jan. 1974 - 23 Apr. 1975
G. Schaefer, R. Ward, and L. Zakraysek Jul. 1975 144 p refs
(Contract F30602-74-C-0118; AF Proj. 5519)
(AD-A015723; RADC-TR-75-171) Avail: NTIS CSCL 09/5

Oxidation studies made on several vendor Fe-Ni-Co (ASTM-

F15) glass sealing alloys show these alloys to differ in both rate of oxidation and adherence of the oxide to the metal. Differences in surface preparation, surface roughness, and atmosphere control on rate and adherence were shown to affect both rate of oxidation and adherence. Using the curves established in these rate studies, samples were oxidized to predetermined thickness. Those selectively oxidized samples were 'sealed' with commercial glasses. Adherence of the glass to metal is shown to be related to oxide thickness and the energy input used in sealing. GRA

N76-18358# Naval Air Systems Command, Washington, D.C.
CONFORMAL ANTENNAS, RESEARCH PROGRAM REVIEW AND WORKSHOP
Apr. 1975 191 p refs Held at Arlington, Virginia, 15-16 Apr. 1975
(AD-A015630) Avail: NTIS CSCL 09/5

Contents: Conformal arrays in tactical missiles, RPVs, and aircraft; Polarization requirements for conformal arrays; Discussion of a symmetrical multibeam feed networks for circular arrays; Conical arrays, studies and experiment; Surface ray analysis of conformal arrays; Flush mounted radiating elements for conformal arrays; Analysis of arrays on a conducting conical surface; Circular and cylindrical arrays; STAR - A conformal array technique for airborne application; Conformal antenna array configurations report; Some issues in the application of cylindrical arrays to radars. GRA

N76-18359# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
TECHNICAL SERVICES PROGRAM Final Report, Apr. 1973 - Sep. 1974
Jan. 1975 179 p refs
(Contract DAAK02-73-C-0284)
(AD-A013504) Avail: NTIS CSCL 09/1

The program, performed by Westinghouse for the U. S. Army Night Vision Laboratories, covered a period from April, 1973, through September, 1974. The effort consisted of two distinct phases. The first phase was a generalized advisory effort to aid the Night Vision Laboratories in understanding, and conducting a program to evaluate image tubes for non-standard television parameters to an AF/ESD specification. The second phase was to provide more direct support in the final operation, calibration, and use of the Night Vision Laboratories test facility to perform the image tube evaluation based on the specialized requirements of the Electronics Systems Division (ESD), and the Space and Missiles Systems Organization (SAMSO) of the U. S. Air Force. GRA

N76-18360# Texas Univ., Austin. Plasma Physics Lab.
EVALUATION OF NOISE SUPPRESSING TRANSMISSION LINES
C. R. Skipping and M. E. Oakes Jan. 1975 36 p refs
(Contract DAEA18-74-C-0224)
(AD-A016280) Avail: NTIS CSCL 09/1

Modeling the behavior of transmission lines and wave filters and the theory of wave propagation in solids involves extensive study of waves supported by iterative networks or lattice structures. It can be shown that for a given frequency, the iterative circuit diagrammed in Figure 1 supports two models of oscillation. Furthermore, in such a structure where the capacitances vary with the nodal index n, there can be regions where either mode reflects and linearly converts to the other. Figure 2 shows the dispersion relation for a case analogous to what can be encountered in geometrical optics. That is, a case where a slow linear variation in the capacitances has been put into the dispersion relation obtained for a uniform lattice. A thorough analytic treatment of a bimodal LC lattice structure for both uniform and nonuniform cases was carried out. The results aid significantly in clarifying and giving direction to the task of computer evaluations. GRA

N76-18175* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-POWER TRANSMITTER HIGH-VOLTAGE POWER SUPPLY RIPPLE
E. J. Finnegan *In its* The Deep Space Network 15 Feb. 1976 p 84-87 (For availability see N76-18163 09-12)
CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-18361 Ohio State Univ., Columbus.
EVAPORATION HEAT TRANSFER IN HEAT PIPES Ph.D. Thesis
Robert Raymond Barthelemy 1975 200 p
Avail: Univ. Microfilms Order No. 76-3375

The heat transfer process occurring in the evaporator section of heat pipes was investigated in order to obtain a better understanding of the phenomena involved in the process. The process occurring in the evaporator section was studied for actual heat pipe wick structures capable of operation at high heat fluxes. Composite wick structures of grooves and consolidated metal wicks were examined and water was used as the working fluid. The interface between the wick and the heated surface was given particular attention. More than twenty-five heat pipes were evaluated to obtain a representative cross-section of data for real heat pipes. A true heat pipe design was used for all heat pipe tests in order to examine actual heat pipe operating phenomena. An everted apparatus which utilized radial heat transfer through the metallic inner cylinder and had a glass outer containment cylinder which allowed visual and diagnostic observations from above was employed. Infrared thermal detection and high magnification visual observation was employed in order to observe density variations, boiling, and dry-out phenomena in the wicks. Extensive temperature measurements were taken on the heater block, heat pipe surfaces and in the vapor. Dissert. Abstr.

N76-18362 Wisconsin Univ., Madison.
THE EVAPORATING FALLING FILM ON HORIZONTAL TUBES Ph.D. Thesis
Philip J. P. Liu 1975 119 p
Avail: Univ. Microfilms Order No. 75-23856

Results of both experiment and analysis are presented. The heat transfer coefficient variations around the tube were measured. Attempts were made to predict the test results from fundamental principles. The boundary layer flow equations of momentum, thermal energy and turbulent energy were solved together using uniform initial profiles of velocity determined from the vertical spacing of tubes, temperature equal to saturation temperature and turbulent energy as a small fraction of the initial mean flow kinetic energy. The solution of the conservation equations of a turbulent flow requires accurate description of the variation of eddy diffusivities along the flow and across the film. Within the limited test range of variables, the theories predicted also an indifference of the heat transfer coefficients to changes of flow rate, heat flux and tube diameter. The predicted results agreed with the test results as to magnitude, variation of heat transfer coefficients and the effects of tube spacing and fluid properties. The Patankar and Spalding finite difference procedure was used to solve the simultaneous partial differential equations. It uses the stream function as a coordinate. Dissert. Abstr.

N76-18363 North Carolina State Univ., Raleigh.
LAMINAR FILM CONDENSATION OF A LIQUID METAL IN A VERTICAL CHANNEL IN THE PRESENCE OF AN ELECTROMAGNETIC FORCE Ph.D. Thesis
John William Sheffield 1975 87 p
Avail: Univ. Microfilms Order No. 76-2422

An implicit finite-difference method was used to solve the boundary layer form of the conservation equations for both a laminar liquid phase and a turbulent vapor phase for the problem of liquid metal condensation on a vertical channel in the presence of an electromagnetic force. A special coordinate system, which adjusts its cross stream width to conform with the boundary layer, was used. The velocity and temperature profiles for the two phase condensation problem were obtained by the numerical technique for different values of the applied electric and magnetic fields, the entrance interface velocity and the entrance liquid layer thickness. The condensation heat transfer was

investigated and discussed. The use of an electromagnetic force accelerated the liquid film and improved the condensation heat transfer for the case of a liquid metal. Dissert. Abstr.

N76-18364* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXHAUST FLOW DEFLECTOR Patent
John C. Wilson and Craig S. Shaw, inventors (to NASA) Issued 24 Feb. 1976 5 p Filed 25 Jun. 1974 Supersedes N74-28233 (12 - 17, p 2084)
(NASA-Case-LAR-11570-1; US-Patent-3,940,097; US-Patent-Appl-SN-482967; US-Patent-Class-244-23D; US-Patent-Class-60-316) Avail: US Patent Office CSCL 20D

A deflector is reported for reducing swirling flow spillover occurring when gas flowing through curved ducting attempts to exit into a freestream flow. The deflector is arcuately shaped and positioned upstream and adjacent the exit end of the curved ducting. As the freestream flow travels over the surface of the deflector, it is turned toward the direction of the flow from the exit of the ducting and draws the exiting flow along with it. The drawn exit flow is straightened and strengthened and is able to penetrate into the freestream flow. The ends of the deflector generate vortices which draw along the swirling flow at the sides of the exit end and straighten and strengthen it also. Official Gazette of the U.S. Patent Office

N76-18365 North Carolina State Univ., Raleigh.
ANALYSIS OF TURBULENT BOUNDARY LAYERS WITH MASS ADDITION AND COMBUSTION Ph.D. Thesis
Chao-Ching Tao 1975 68 p
Avail: Univ. of Microfilms Order No. 76-2439

A combustible mixture was injected into a boundary layer over a flat plate and was ignited by external means. A 'flame sheet' model was employed to describe the combustion process and three different models for the eddy viscosity were employed to study the turbulent flow field. These are: (1) the original Cebeci's model, (2) a modified Cebeci's model to allow for the presence of combustion, and (3) a combined model. Based on the comparisons between calculated solutions and experimental data, it is found that: (1) the original Cebeci's model results in a velocity profile which is not in good agreement with experiment, (2) the modified Cebeci's model results in an improvement in the prediction of the velocity profile especially in the lower region near the wall, and (3) the combined model predicts fairly well the velocity profile, the boundary layer thickness, the flame sheet position and the position of the inflection point. Dissert. Abstr.

N76-18366 North Carolina State Univ., Raleigh.
STATISTICAL PROPERTIES OF FLUID MOTION AND FLUID FORCE IN A RANDOM WAVE FIELD Ph.D. Thesis
Keikhosrow Pajouhi 1975 104 p
Avail: Univ. Microfilms Order No. 76-2447

Statistical properties of wave field kinematics, pressure and wave forces extending beyond the mean water level are derived, taking into consideration the free surface fluctuation phenomenon. These include the probability density function, mean, variance, skewness, covariance, and spectrum. Numerical results are obtained and presented graphically. Appreciable differences are observed when results are compared with the case when the free surface fluctuation phenomenon is neglected. This is especially true at around and above the mean water level. Since most of the water movements are centered around and above the mean water level, the results of this investigation are shown to have important implications in wave research as well as wave force evaluations relevant to the design of marine structures that protrude above the mean water level. Dissert. Abstr.

N76-18367 Colorado State Univ., Fort Collins.
A SOLUTION FOR UNSTEADY OPEN CHANNEL FLOW Ph D. Thesis
Fredrick Douay Theurer 1975 138 p
Avail: Univ. Microfilms Order No. 76-4334

The one-dimensional unsteady open channel flow equations are solved by the fixed grid method of characteristics with a unique interpolating function. No limitation on the solution is foreseen regarding distance between cross-sections, boundary conditions, Froude number, or channel geometry when using the concepts developed. The computer program was developed for Froude numbers equal to or less than one; with recoding, there is no theoretical limit to the Froude number. The solution can duplicate steady-state conditions and is an improvement over previously used techniques for unsteady flow. The basic governing equations, as well as a compact, yet general, form of the characteristic line and integral equations are derived; the governing partial differential equations are converted to a readily solvable ordinary differential equation form. The steady-nonuniform flow equation is derived from the unsteady flow equations. A satisfactory procedure was developed to solve the resulting equation using a Taylor series expansion for the nonlinear friction term. Dissert. Abstr.

N76-18368 Florida Univ., Gainesville.
A METHOD OF ANALYSIS FOR THREE-DIMENSIONAL VISCOUS FLOW IN CENTRIFUGAL IMPELLERS Ph.D. Thesis
Frank Warren Lincoln 1975 228 p
Avail: Univ. Microfilms Order No. 76-4254

An analytical model is developed for steady, incompressible flow in shrouded centrifugal impellers of arbitrary design. The method is based on the assumption of an inviscid core flow with surrounding boundary layers on the passage walls. The core flow calculation, which is applicable to incompressible or subsonic compressible flow, employs a streamline curvature technique to solve the governing equations on two intersecting families of stream surfaces. By employing several hub-to-shroud and blade-to-blade stream surfaces whose coordinates are determined as part of the solution, a truly three-dimensional analysis is achieved. An orthogonal streamline coordinate system is used in the solution of boundary layer momentum integral equations which include the effects of rotation and streamline curvature. Simple models for the boundary layer crossflow velocity profiles and the secondary flow in the corner regions permits a step-by-step calculation of the boundary layers on the hub, shroud and blade surfaces. Dissert. Abstr.

N76-18369 Oklahoma Univ., Norman.
FLUID DYNAMICS OF A TORNADO-LIKE VORTEX FLOW Ph.D. Thesis
Masood Parang 1975 216 p
Avail: Univ. Microfilms Order No. 76-3123

A swirling, converging vortex flow was studied both experimentally and theoretically as a model of tornado flowfields. Laboratory measurements of this vortex flowfield were obtained using Ward's apparatus, and such unique features as the multiple-vortex phenomenon were studied. The turbulent boundary-layer due to this swirling converging vortex flowfield was investigated theoretically by means of Von Karman's integral momentum method. In addition, a recirculating vortex core model was studied. Using a nonequilibrium condensation process as a basis, distinctions between the observed tornado funnel and other aspects of the core flow are discussed. Dissert. Abstr.

N76-18370 Minnesota Univ., Minneapolis.
TURBULENT FLOW AND HEAT TRANSFER IN ROTATING ENCLOSURES Ph.D. Thesis
Luciano Michele DeSocio 1975 183 p
Avail: Univ. Microfilms Order No. 76-4042

The problem of flow and heat transfer in a rotating enclosure was solved in two steps. A numerical method is presented for solving the complicated elliptic equations of steady flows with recirculation; the method is called the contrived transient explicit method. The second step was to determine an approximate average value of the turbulent diffusivity for momentum transfer in the enclosure. The contrived transient-explicit method proved to be fast and reliable in comparison with other existing procedures. As an application, the laminar flow in a rotating enclosure is considered. The determination of the average value of the eddy diffusivity for momentum was carried out by solving the turbulent flow equations for different values of the ratio between the eddy diffusivity and the kinematic viscosity, until good agreement with existing experimental results was obtained. The constant scalar eddy diffusivity model for the core region of the enclosure was matched with a Van Driest model in the region near to the wall. Dissert. Abstr.

N76-18371 Colorado Univ., Boulder.
ON THE STABILITY OF SOME FLUID FLOWS Ph.D. Thesis
Abdelfattah M. G. Zebib 1975 106 p
Avail: Univ. Microfilms Order No. 76-3970

The spatial stability of the similarity solution describing a boundary layer separated by mass addition is considered. The flow structure is described in terms of a three-layer model. Adjacent to the wall there is a layer of inviscid rotational injectant fluid; above this lies a relatively thin viscous free shear layer. These two layers act as an effective displacement body which disturbs the basically uniform, inviscid, irrotational external flow. The resulting interaction produces a favorable pressure gradient in the wall layer. Study of the approach of a slightly nonsimilar initial velocity profile to the similarity profile gives rise to the shear layer eigenvalue problem. The eigenfunctions generated in the shear layer cause disturbances in the wall layer and the external flow through the mechanism of the interaction phenomenon. In a second problem, a study was made of an unstable Kelvin-Helmholtz wave in a stratified shear flow with continuous velocity and density profiles. Weak nonlinear effects associated with the Reynolds stresses were found to alter the shear profile at a critical level. This change was found to stabilize the shear profile. Dissert. Abstr.

N76-18372*+ New Mexico Univ., Albuquerque. Tech. Application Center.
HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Annual Supplement, 1974
1974 133 p Sponsored in part by NASA
(NASA-CR-146328; TAC-HP-74-102) Avail: NTIS; Univ. of New Mexico, Tech. Application Center HC $20.00 CSCL 20M

This bibliography lists 149 references with abstracts and 47 patents dealing with applications of heat pipe technology. Topics covered include: heat exchangers for heat recovery; electrical and electronic equipment cooling; temperature control of spacecraft; cryosurgery; cryogenic, cooling; nuclear reactor heat transfer; solar collectors; laser mirror cooling; laser vapor cavitites; cooling of permafrost; snow melting; thermal diodes variable conductance; artery gas venting; and venting; and gravity assisted pipes. Author

N76-18373*+ New Mexico Univ., Albuquerque. Tech. Application Center.
HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Annual Supplement, 1973
1973 222 p Sponsored in part by NASA
(NASA-CR-146329; TAC-HP-73-101) Avail: NTIS; Univ. of New Mexico, Tech. Application Center HC $15.00 CSCL 20M

This bibliography lists 229 references with abstracts and 94 patents dealing with applications of heat pipe technology. Topics covered include: heat exchangers for heating and air conditioning; electronics cooling; temperature control of spacecraft; heat transfer in thermoelectric power generators; heat transfer in nuclear reactors; measurement of thermophysical properties; solar collectors; cooling engines; electrohydrodynamic phenomena; and vapor laser ovens. Author

N76-18374* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAT TRANSFER DEVICE Patent
Larry R. Eaton, inventor (to NASA) (McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.) Issued 24 Feb. 1976 6 p Filed 21 Jan. 1975 Supersedes N75-15902 (13 - 07, p 0767) Sponsored by NASA
(NASA-Case-MFS-22938-1; US-Patent-3,940,621; US-Patent-Appl-SN-542754; US-Patent-Class-250-335) Avail: US Patent Office CSCL 20D

An improved heat transfer device particularly suited for use as an evaporator plate in a diffusion cloud chamber. The device is characterized by a pair of mutually spaced heat transfer plates, each being of a planar configuration, having a pair of opposed surfaces defining therebetween a heat pipe chamber. Within the heat pipe chamber, in contiguous relation with the pair of opposed surfaces, there is disposed a pair of heat pipe wicks supported in a mutually spaced relationship by a foraminous spacer of a planar configuration. A wick including a foraminous layer is contiguously related to the external surfaces of the heat transfer plates for uniformly wetting these surfaces.
Official Gazette for the U.S. Patent Office

N76-18375*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEAT PIPES FOR SPACECRAFT TEMPERATURE CONTROL: AN ASSESSMENT OF THE STATE-OF-THE-ART
J. P. Kirkpatrick and M. Groll Jan. 1976 21 p refs
(NASA-TM-X-73096) Avail: NTIS HC $3.50 CSCL 20M

Various heat pipe temperature control techniques are critically evaluated using characteristic features and properties, including heat transport capability, volume and mass requirements, complexity and ease of fabrication, reliability, and control characteristics. Advantages and disadvantages of specific approaches are derived and discussed. Using four development levels, the state of-the-art of the various heat pipe temperature control techniques is assessed. The need for further research and development is discussed and suggested future efforts are projected. Author

N76-18376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TWO-PHASE CHOKED FLOW OF SUBCOOLED OXYGEN AND NITROGEN
Robert C. Hendricks, Robert J. Simoneau, and Richard F. Barrows Washington Feb. 1976 42 p refs
(NASA-TN-D-8169; E-8499) Avail: NTIS HC $4.00 CSCL 20D

Data are presented for two-phase critical flow through nozzles. Test results from two converging-diverging nozzles and two separate test facilities are in excellent agreement. The critical flow rate and critical flow pressure ratio data conclusively demonstrate that the principle of corresponding states can be applied to two-phase choked flow through nozzles. Normalizing parameters were developed to correlate these data, and current theories can provide an adequate means for extrapolating to other fluids. Such information can be useful for cryogenic fluid storage applications. Author

N76-18377# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
INTEGRAL METHOD OF SOLUTION FOR COMPRESSIBLE LAMINAR BOUNDARY LAYERS AND APPLICATIONS
W. S. Liu Dec. 1975 37 p refs
(Grant AF-AFOSR-72-2274C)
(UTIAS-TN-195; CN-ISSN-0082-5263) Avail: NTIS HC $4.00

Basic equations for solving compressible, laminar, boundary-layer flows are considered in some detail. The moment of momentum equation was added to the usual boundary-layer equations in order to form a complete set of equations. The governing equations for shock-wave or expansion-wave interactions with the boundary-layer were reformulated. The cold-wall similarity model of the interaction of a compressible, laminar, boundary-layer flow with a corner-expansion wave was investigated using certain approximations and initial conditions. The results compare well with other analytical models with existing experimental data. Author

N76-18378# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
CONDENSATION OF WATER VAPOUR WITH OR WITHOUT A CARRIER GAS IN A SHOCK TUBE
Jean Pascal Sislian Nov. 1975 120 p refs
(Grant AF-AFOSR-72-2274)
(UTIAS-201; CN-ISSN-0082-5255) Avail: NTIS HC $5.50

A detailed theoretical investigation has been made of the condensation of water vapor with or without a carrier gas in the nonstationary rarefaction wave generated in a shock tube. All possible situations such as frozen, nonequilibrium and equilibrium flows have been considered. In the case of equilibrium condensation, analytical expressions were obtained for all the flow variables in the rarefaction wave for the cases of pure water vapor and water vapor/nitrogen mixtures. In the nonequilibrium flow case when condensation takes place by homogeneous nucleation, the equation of motion together with the nucleation rate and the droplet growth equations were solved numerically by the method of characteristics and Lax's method of implicit artificial viscosity. Author

N76-18379*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
NONLINEAR PROPAGATION OF A WAVE PACKET IN A HARD-WALLED CIRCULAR DUCT
Ali Hasan Nayfeh May 1974 18 p refs
(Grant NGR-47-004-109)
(NASA-CR-146326; VPI-E-74-9) Avail: NTIS HC $3.50 CSCL 20D

The method of multiple scales is used to derive a nonlinear Schroedinger equation for the temporal and spatial modulation of the amplitudes and the phases of waves propagating in a hard-walled circular duct. This equation is used to show that monochromatic waves are stable and to determine the amplitude dependance of the cut off frequencies. Author

N76-18380*# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
AN EXPERIMENTAL INVESTIGATION OF THE MIXING AND COMBUSTION OF AN UNDEREXPANDED H2 JET IN SUPERSONIC FLOW M.S. Thesis
Renaldo Vincent Jenkins Feb. 1976 160 p refs Sponsored by NASA
(NASA-CR-146346) Avail: NTIS HC $6.75 CSCL 20D

The interaction of an underexpanded hydrogen jet coaxially injected into supersonic flow is investigated experimentally. Experimental results are discussed and analyzed. Comparisons are made between the experimental results and theoretical predictions computed using an analytical technique. Changes to improve the theory are suggested. Author

N76-18381*# Fluid Mechanics and Thermal Systems, Inc., Waverly, Ala.
COMBUSTION OF HYDROGEN INJECTED INTO A SUPERSONIC AIRSTREAM (A GUIDE TO THE HISS COMPUTER PROGRAM) Final Report
D. F. Dyer, G. Maples, and D. B. Spalding Washington NASA Mar. 1976 76 p refs
(Contract NAS1-13239)
(NASA-CR-2655) Avail: NTIS HC $5.00 CSCL 20D

A computer program based on a finite-difference, implicit numerical integration scheme is described for the prediction of hydrogen injected into a supersonic airstream at an angle ranging from normal to parallel to the airstream main flow direction. Results of calculations for flow and thermal property distributions were compared with 'cold flow data' taken by NASA/Langley and show excellent correlation. Typical results for equilibrium combustion are presented and exhibit qualitatively plausible behavior. Computer time required for a given case is approximately one minute on a CDC 7600. A discussion of the assumption of parabolic flow in the injection region is given which demonstrates that improvement in calculation in this region could be obtained by a partially-parabolic procedure which has been developed. It is concluded that the technique described provides an efficient and reliable means for analyzing hydrogen injection into supersonic airstreams and the subsequent combustion. Author

N76-18382*# Stanford Univ., Calif.
FULL-COVERAGE FILM COOLING HEAT TRANSFER STUDY: SUMMARY OF DATA FOR NORMAL-HOLE INJECTION AND 30 DEG SLANT-HOLE INJECTION Final Report
M. E. Crawford, H. Choe, W. M. Kays, and R. J. Moffat Washington NASA Mar. 1976 145 p refs
(Contract NAS3-14336)
(NASA-CR-2648; SU-HMT-19) Avail: NTIS HC $6.00 CSCL 20D

Heat transfer to a full coverage film cooled turbulent boundary layer over a flat surface was studied. The surface consisted of a discrete hole test section containing 11 rows of holes spaced 5 diameters apart in a staggered array and an instrumented recovery region. Ten diameter spacing was also studied by plugging appropriate holes. Two test sections were used, one having holes normal to the surface and the other having holes angled 30 deg to the surface in the downstream direction. Stanton number data were obtained both in the full coverage region and in the downstream recovery region for a range of blowing ratios, or mass flux ratios, from 0 to 1.3. Initial conditions at the upstream edge of the blowing region were varied from 500 to 5000 for momentum thickness Reynolds number and from 100 to 1800 for enthalpy thickness Reynolds number. The range of Reynolds numbers based on hole diameter and mainstream velocity was 6000 to 22000. Initial boundary layer thicknesses range from 0.5 to 2.0 hole diameters. Air was used as the working fluid. The data were taken for the secondary injection temperature equal to the wall temperature and also equal to the mainstream temperature. Superposition was then used to obtain Stanton number as a continuous function of the injectant temperature. The heat transfer coefficient was defined on the basis of a mainstream-to-wall temperature difference. This definition permits direct comparison of performance between film cooling and transpiration cooling. Author

N76-18383*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STREAKLINE FLOW VISUALIZATION OF DISCRETE HOLE FILM COOLING WITH HOLES INCLINED 30 DEG TO SURFACE
Raymond S. Colladay, Louis M. Russell, and Jan M. Lane Washington Mar. 1976 16 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-8175; E-8570) Avail: NTIS HC $3.50 CSCL 20D

Film injection from three rows of discrete holes angled 30 deg to the surface in line with mainstream flow and spaced 5 diameters apart in a staggered array was visualized by using helium bubbles as tracer particles. Both the main stream and the film injectant were ambient air. Detailed streaklines showing the turbulent motion of the film mixing with the main stream were obtained by photographing small, neutrally buoyant helium-filled soap bubbles which followed the flow field. The ratio of boundary layer thickness to hole diameter and the Reynolds number were typical of gas turbine film cooling applications. The results showed the behavior of the film and its interaction with the main stream for a range of blowing rates and two initial boundary layer thicknesses. Author

N76-18384*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
EXTENSION OF THE PARABOLIC METHOD FOR TRANSONIC FLOW: STATIONARY FLOW AND EXTENSION OF THE PARABOLIC METHOD FOR TRANSONIC FLOWS: UNSTEADY FLOW
K. H. Oehmen and I. Teipel Washington NASA Jan. 1976 7 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (East Ger.), v. 55, 1975 p T143-T146
(Contract NASw-2789)
(NASA-TT-F-16856) Avail: NTIS HC $3.50 CSCL 20D

The nonlinear initial equation of the theory of first order for transonic flow is given the form of an inhomogenous parabolic differential equation. An approach is shown for obtaining an analytical solution with convergent integrals. Results computed for the pressure distribution in the case of two different profiles are presented in graphs. The computed values were compared with experimental data. Approximate solutions for the unsteady case were derived for the flow at the profile on the basis of linear inhomogenous parabolic differential equations. Author

N76-18385# Argonne National Lab., Ill.
DYNAMIC RESPONSE OF TWO PARALLEL CIRCULAR CYLINDERS IN A LIQUID
S. S. Chen May 1975 35 p refs
(Contract W-31-109-eng-38)
(ANL-CT-75-40) Avail: NTIS HC $4.75

The problem of two parallel circular cylinders vibrating in a liquid was studied analytically. The equations of motion including fluid coupling are formulated using the added mass concept. A closed form solution and an approximate solution were obtained for free vibration. The steady state responses of two cylinders subjected to harmonic excitations are presented. The results illustrate the significance of the interaction of two structures in a liquid. Author (NSA)

N76-18386# Los Alamos Scientific Lab., N.Mex.
NUMERICAL CALCULATION OF TWO-PHASE FLOWS
J. R. Travis, F. H. Harlow, and A. A. Amsden Jun. 1975 12 p refs
(Contract W-7405-eng-36)

(LA-5942-MS) Avail: NTIS HC $4.00

The theoretical study of time varying two-phase flow problems in several space dimensions introduces such a complicated set of coupled nonlinear partial differential equations that numerical solution procedures for computers are required in almost all but the simplest examples. Efficient attainment of realistic solutions for practical problems requires a finite difference formulation that is simultaneously implicit in the treatment of mass convection, equations of state, and the momentum coupling between phases. Such a method is described, the equations on which it is based are discussed, and its properties are illustrated by means of examples. The capability for calculating physical instabilities and other time varying dynamics, at the same time avoiding numerical instability is emphasized. The computer code is applicable to problems in reactor safety analysis, the dynamics of fluidized dust beds, raindrops or aerosol transport, including the effects of phase transitions and the release of latent heat or chemical energy. Author (NSA)

N76-18387# Naval Research Lab., Washington, D.C.
SHOCK WAVE PROPAGATION IN AN INHOMOGENEOUS MEDIUM USING FINITE DIFFERENCES Interim Report
D. G. Colombant and H. H. Gardner Sep. 1975 28 p refs
(NRL Proj. H02-27; DNA Proj. NWED-HC-062)
(AD-A016192; NRL-MR-3116) Avail: NTIS CSCL 20/4

One-dimensional propagation of a strong shock wave in a medium with an exponentially varying density is studied numerically. Solutions using various formulations of the energy equation are compared with the self-similar analytic solution. It was found that only the conservative energy equation predicts the correct shock propagation; the temperature and pressure formulations, even with artificial viscosity are far less satisfactory. This result holds over a wide range of different spatial resolutions and for different finite-difference algorithms. GRA

N76-18388# Pennsylvania Transportation Inst., University Park. Applied Research Lab.
A VALIDATION STUDY OF THE MIXED FOIL CONCEPT FOR HIGH SPEED HYDROFOILS
D. P. Wang and Y. T. Shen 18 Jun. 1975 52 p refs
(Contract N00017-73-C-1418)
(AD-A015695; TM-75-171) Avail: NTIS CSCL 20/4

A hydrodynamic validation study of the concept of the mixed foil has been carried out. A mixed foil is a streamlined hydrofoil equipped with a flap or other device which, above a certain speed, can be activated so as to change the flow around the foil into a supercavitating flow. At takeoff and at moderate speeds, a mixed foil is operated as a subcavitating foil; at high speeds, it is operated as a supercavitating foil. During high speed operations, a reduction in the wetted planform area of a mixed foil is proposed. Two hydrofoils which have as their sections plano-convex foils of thickness to chord ratios of 5% and 6% are used for the study. GRA

N76-18389# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
COMPARISON OF COMPUTER PREDICTED AND EXPERIMENTALLY DETERMINED LEADING EDGE CAVITATION OF A FOIL WITH FLAPS Final Report
Richard M. Norton and Benjamin B. Wisler Aug. 1975 27 p ref
(AD-A015874; SPD-326-06) Avail: NTIS CSCL 20/4

A model test and computer study were compared to assess the ability of a computer program to predict leading-edge cavitation inception. A 1/8 scale model of the PCH-1 forward foil was tested in the high speed towing tank at the David W. Taylor Naval Ship Research and Development Center and assessed by a two-dimensional computer program. Included is the method developed to take into account small flap angles. The results indicate that the two-dimensional program is able to make satisfactory predictions of leading edge cavitation for the PCH-1 foil when invested with three-dimensional values of the lift coefficient and the lift curve slope. Author (GRA)

N76-18390# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
HYDRODYNAMIC CHARACTERISTICS OF A CONTROL SURFACE Final Report
Charles G. Moody Sep. 1975 31 p refs
(AD-A015962; SPD-640-01) Avail: NTIS CSCL 20/4

A study of the performance of a low-aspect-ratio, all-movable control surface in water is presented and compared with the performance of similar control surfaces in air. The results of this study show the free-stream characteristics of a control surface with an NACA 0015 section and a 45 percent taper ratio for different conditions affecting cavitation and stall. It is concluded that large angles of attack should be avoided under conditions that may cause stall. Author (GRA)

N76-18391# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EFFECT OF SHOCK IMPINGEMENT ON HEAT TRANSFER. PART 3: AN INVESTIGATION OF ADIABATIC LAMINAR BOUNDARY LAYER/SHOCK WAVE INTERACTIONS ON CURVED WALLS Interim Scientific Report, 1 Jan. - 31 Dec. 1974
Jean J. Ginoux and David S. Dolling Jan. 1975 65 p refs
(Grant AF-AFOSR-2147-71; AF Proj. 9781)
(AD-A015913; VKI-TN-105-Pt-3; AFOSR-75-1239TR; ISR-4) Avail: NTIS CSCL 20/4

Static pressure distributions in supersonic flow have been measured on the surface of a flat plate/curved ramp model and on a flat plate curved afterbody model with equivalent impinging shock. Under adiabatic supersonic flow conditions, an equivalence between the two configurations is shown to exist. Using this concept of equivalence the Lees-Reeves-Klineberg integral method has been successfully modified to include surface curvature and the predicted static pressure distributions compared directly with the experimental curved ramp data. GRA

N76-18392# ARO, Inc., Arnold Air Force Station, Tenn.
PRESSURE AND HEAT TRANSFER TESTS ON THE NASA SPACE SHUTTLE EXTERNAL TANK AT MACH NUMBER 16 Final Report, 9 Aug. - 20 Sep. 1974
L. G. Siler and A. H. Boudreau AEDC Oct. 1975 49 p refs
(ARO Proj. V41F-25A; AF Proj. 921E)
(AD-A015743; ARO-VKF-TR-74-129; AEDC-TR-75-31) Avail: NTIS CSCL 20/4

An experimental test program was conducted in the AEDC-VKF Hypervelocity Wind Tunnel (F) at a nominal Mach number of 16 to obtain basic heating and pressure distribution data on the NASA space shuttle external tank. The tests were conducted over an attitude range which simulated tank tumbling after separation from the shuttle orbiter. The angles of attack varied from 0 to -180 deg with combinations of roll from 0 to 90 deg at free-stream Reynolds numbers (based on model length) from 0.38 x 1,000,000 to 1.10 x 1,000,000. In addition to surface heat-transfer gages, thermographic phosphor paint was used to determine the interference heating factors on and around the various attachment structures and service ducts. GRA

N76-18393# Polytechnic Inst. of New York, Farmingdale. Dept. of Aerospace Engineering and Applied Mechanics.
THE VISCOUS LAYER IN THE SYMMETRY PLANE OF SHARP CONE AT INCIDENCE Interim Report
S. G. Rubin, T. C. Lin, and F. Tarulli Jun. 1975 55 p refs
(Grant AF-AFOSR-2635-74; AF Proj. 9781)
(AD-A015915; POLY-AE/AM-75-8; AFOSR-75-1352TR) Avail: NTIS CSCL 20/4

Numerical solutions for the wind and lee symmetry planes on sharp cones at incidence are obtained for both laminar and turbulent boundary layers. Comparisons are made between solutions obtained with the similarity boundary layer equations, the non-similar boundary layer equations and the non-similar boundary region equations. For large incidence, after crossflow reversal has occurred, non-similar boundary layer solutions are obtained at the leeplane but are in poor agreement with experimental data. For turbulent flows, non-similar boundary layer solutions are obtained in all cases. GRA

N76-18394# AiResearch Mfg. Co., Phoenix, Ariz.
SEPARATED FLOW PROGRAM FOR OFFICE OF NAVAL RESEARCH Annual Report, 15 Jun. 1974 - 15 Jun. 1975
P. R. Dodge 15 Jun. 1975 152 p
(Contract N00014-74-C-0317; NR Proj. 061-221)

(AD-A015707; Rept-74-211196-4) Avail: NTIS CSCL 20/4

This document describes the results of the past year of a study for evaluating a numerical method for solution of the ensemble-averaged Navier-Stokes equations. GRA

N76-18395# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

EFFECTIVE CENTERED EXPANSIONS IN SHOCK TUBE FLOWS FOR CONDENSATION STUDIES

C. F. Lee Jun. 1975 25 p refs

(Contract N00014-67-A-0097-0012)

(AD-A015692) Avail: NTIS CSCL 20/4

Experimental investigations of the shock tube expansion flow have been carried out in the driver section by measuring the wall static pressure-time histories at three different observation stations. It is found that the effects of non-idealities in the actual flow manifest themselves predominatly close to the origin of the expansion process. A shift in the origin of the expansion process with respect to the diaphragm location is thus produced. The 'virtual origin' of the expansion can be determined by wall static pressure measurement at a single observation station and the effects of the nonidealities in real flow can be corrected once this virtual origin is found experimentally. A much improved shock tube method of studying condensation now exists in which the flow properties in the expansion fan are completely determined by static pressure measurements at two different observation stations with the onset of condensation determined by light scattering as before. GRA

N76-18396# DCW Industries, Sherman Oaks, Calif.

EFFECTS OF SURFACE HEAT TRANSFER ON BOUNDARY LAYER TRANSITION Interim Report, 1 Apr. - 30 Jul. 1975

David C. Wilcox Jul. 1975 36 p refs

(Contract F44620-74-C-0048; ARPA Order 2980; AF Proj. 9781)

(AD-A015938; DCW-R-03-03; AFOSR-75-1398TR) Avail: NTIS CSCL 20/4

Effects of surface heat transfer on boundary-layer transition are analyzed in a three-part study using the Saffman-Wilcox transition model. In the first part model predictions are compared with experimental data for cooled and heated aerodynamic boundary layers on smooth flat surfaces and for cooled aerodynamic boundary layers near the stagnation point of a roughened blunt body. Next, incipient transition conditions are determined for a small, heated hydrodynamic body. In the final part of the study, transition location is determined for a large hydrodynamic body; results indicate that large surface heating rates are not substantially more effective than smaller rates. GRA

N76-18397# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

AXIAL FLOW ROTOR UNSTEADY RESPONSE TO CIRCUMFERENTIAL INFLOW DISTORTIONS Summary Report, 1 Oct. 1973 - 30 Sep. 1974

E. P. Bruce (Pa. State Univ., University Park) and R. E. Henderson (Pa. State Univ., University Park) Aug. 1975 53 p refs

(Contract N00014-67-A-0226-0005; NR Proj. 098-038)

(AD-A016049; SQUID-TR-PSU-13-P) Avail: NTIS CSCL 13/7

The unsteady response of an axial flow fan rotor to steady, circumferential inflow velocity distortions has been evaluated by investigation of the unsteady normal force and pitching moment on a chordwise element of a rotor blade. Experimental measurements of these unsteady characteristics are presented as a function of the geometry of the rotor -- stagger angle, solidity and steady angle of incidence -- for sinusoidally varying circumferential distortions with different numbers of distortion cycles. These measurements are compared with two theoretical analyses. Clearly indicated is the existence of an unsteady cascade effect and the ability of the theories to adequately predict the trend of the unsteady response due to variations in reduced frequency, rotor stagger angle, solidity and mean incidence angle. GRA

N76-18179* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HEAT TRANSFER CRITERIA OF A TUBULAR SOLAR COLLECTOR: THE EFFECT OF REVERSING THE FLOW PATTERN ON COLLECTOR PERFORMANCE

F. L. Lansing *In its* The Deep Space Network 15 Feb. 1976 p 108-114 refs (For availability see N76-18163 09-12) CSCL 20D

N76-18573 Joint Publications Research Service, Arlington, Va.

METHODS OF CALCULATING THE INTERACTING ADJACENT FLOWS IN RECTILINEAR SECTIONS

V. A. Rozanov *In its* Meteorology and Hydrol., No. 9 (JPRS-66543) 29 Dec. 1975 p 108-115 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 86-91 (For availability see N76-18564 09-42)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-18398 Wisconsin Univ., Madison.

ANALYTICAL PHOTOGRAMMETRY FROM DIGITIZED IMAGE DENSITIES Ph.D. Thesis

Terrence J. Keating 1975 215 p

Avail: Univ. Microfilms Order No. 75-20777

An automated analytical photogrammetric mapping technique was developed to extract topographic coordinates from stereopairs of aerial photography using only a scanning microdensitometer in conjunction with a general purpose digital computer. The spatial and tonal image of film negatives are represented by the densitometer as integer density arrays describing each photograph to the computer. Conjugate imagery is numerically correlated using density difference algorithms to compare similarities between image point arrays. Emphasis was placed upon optimizing the use of pertinent perspective geometric theorems and exploiting epipolar relationships to increase computational efficiency during correlation and subsequent model point determination. Based upon the results and experiences of this research, digital photogrammetric methods can be used to generate, store and utilize terrain coordinates in computer referencing systems.

Dissert. Abstr.

N76-18399 Ohio State Univ., Columbus.

A VACUUM INFRARED SPECTROGRAPH WITH A DIGITAL DATA SYSTEM AND AN IMPROVED TECHNIQUE FOR WAVENUMBER ASSIGNMENT Ph.D. Thesis

Kenneth Michael Haught 1975 156 p

Avail: Univ. Microfilms Order No. 76-3445

Recent advancements in grating technology have led to the commercial production of 16x8 inch precision echelle gratings with the coarse rulings needed for work in the 5 microns to 20 microns infrared spectral region. An earlier six-meter vacuum infrared spectrograph was rebuilt to accommodate one of these large gratings. Along with the new grating, the design incorporated several other improvements in the auxiliary equipment used with the spectrograph. A new carbon rod infrared source furnace was constructed with provisions for later conversion to use with tungsten rods, which could be operated in vacuum. A speed servo controlled drive and an optical shaft encoder were obtained for the grating drive screw. A digital data system was acquired for recording both the infrared signal and the shaft encoder position on a magnetic tape. A related set of PL/I language computer programs were written for processing these tapes.

Dissert. Abstr.

N76-18400* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

METHOD AND APPARATUS FOR TENSILE TESTING OF METAL FOIL Patent

Orval W. Wade, inventor (to NASA) (Martin Marietta Aerospace, Denver) Issued 17 Feb. 1976 6 p Filed 27 Jun. 1974 Supersedes N74-30894 (12 - 20, p 2436) Sponsored by NASA

(NASA-Case-LAR-10208-1; US-Patent-3,938,373;

US-Patent-Appl-SN-483858; US-Patent-Class-73-95;
US-Patent-Class-73-103) Avail: US Patent Office CSCL 14B

A method for obtaining accurate and reproducible results in the tensile testing of metal foils in tensile testing machines is described. Before the test specimen are placed in the machine, foil side edges are worked until they are parallel and flaw free. The specimen are also aligned between and secured to grip end members. An aligning apparatus employed in the method is comprised of an alignment box with a longitudinal bottom wall and two upright side walls, first and second removable grip end members at each end of the box, and a means for securing the grip end members within the box.

Official Gazette of the U.S. Patent Office

N76-18401* National Aeronautics and Space Administration. Pasadena Office, Calif.

SAMPLER OF GAS BORNE PARTICLES Patent

Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Issued 17 Feb. 1976 7 p Filed 28 Mar. 1975 Supersedes N75-21601 (13 - 35, p 1510) Sponsored by NASA
(NASA-Case-NPO-13396-1; US-Patent-3,938,367;
US-Patent-Appl-SN-563283; US-Patent-Class-73-28;
US-Patent-Class-55-261; US-Patent-Class-73-421.5R) Avail: US Patent Office CSCL 14B

An atmosphere sample is described which includes a very thin filter element with straight-through holes on the order of 1 micron. A sample of air with particles to be examined is driven by means of a pressurized low molecular weight gas, e.g. He, to the filter element front side. A partial vacuum may be present at the back side of the filter element. The pressure differential across the filter element is just below the rupture point of the filter element. Particles smaller than filter holes are deposited on the filter element. When using a filter element of plastic material of a thickness on the order of 10 microns, a stainless steel back-up plate and a diffusion member are used to support the filter element when subjected to a pressure differential on the order of a few hundred atmospheres.

Official Gazette of the U.S. Patent Office

N76-18402* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

HOLOGRAPHIC MOTION PICTURE CAMERA WITH DOPPLER SHIFT COMPENSATION Patent

Robert L. Kurtz, inventor (to NASA) Issued 10 Feb. 1976 6 p Filed 17 Sep. 1974 Supersedes N74-33943 (12 - 23, p 2831)
(NASA-Case-MFS-22517-1; US-Patent-3,937,555;
US-Patent-Appl-SN-506804; US-Patent-Class-350-3.5) Avail: US Patent Office CSCL 14E

A holographic motion picture camera is reported for producing three dimensional images by employing an elliptical optical system. There is provided in one of the beam paths (the object or reference beam path) a motion compensator which enables the camera to photograph faster moving objects.

Official Gazette of the U.S. Patent Office

N76-18403* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MODULATED HYDROGEN ION FLAME DETECTOR Patent

John Dimeff, inventor (to NASA) 17 Feb. 1976 4 p Filed 28 Jun. 1974 Supersedes N74-27875 (12 - 17, p 2037)
(NASA-Case-ARC-10322-1; US-Patent-3,938,956;
US-Patent-Appl-SN-484209; US-Patent-Class-23-254EF) Avail: US Patent Office CSCL 14B

In a hydrogen flame detector there is provided a means for modulating the density of a gas stream prior to its introduction into the detector flame. A detector, responsive to the resulting modulation of the flame, is provided for producing an output signal having a component fluctuating at the frequency of modulation. A cross-correlator, responsive to the output signal and a signal at the frequency of modulation, is provided for producing a resultant signal proportional to the cross correlation between its two input signals. A means is further provided for recording or otherwise utilizing the resultant signal thus produced. Office Gazette of the U.S. Patent Office

N76-18404*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN AUTOMATED SECONDARY STANDARD FOR CALIBRATING LIQUID FLOWMETERS

Howard F. Hobart 1976 9 p refs To be presented at the 22d Intern. Instr. Symp., San Diego, Calif., 25-27 May 1976; sponsored by the Instr. Soc. of Am.
(NASA-TM-X-71876; E-8649) Avail: NTIS HC $3.50 CSCL 14B

A secondary working standard of flow calibration has been developed to be used in place of a primary weight-time standard, and which can thereby effect a 75 percent reduction in calibration time while maintaining acceptable accuracies. The secondary standard uses six previously calibrated turbine-type flowmeters built into two manifold systems containing automatically switched flow valves. The pair of systems is capable of covering the flow range of 0.0004 to 19 l/s (0.007 to 300 gpm) with the uncertainty in volume flow rate not exceeding + or - 0.25 percent over the range of 0.06 to 19 l/s and not exceeding + or - 0.5 percent over the range 0.0004 to 0.06 1/s. Data reduction and plotting of results are by computer. Author

N76-18405*# Advanced Kinetics, Inc., Costa Mesa, Calif.

INSTRUCTION MANUAL, OPTICAL EFFECTS MODULE, MODEL OEM

14 Nov. 1975 36 p
(Contract NAS8-31334)
(NASA-CR-144148; Rept-1054-303) Avail: NTIS HC $4.00 CSCL 14B

The Optical Effects Module Model OEM-1, a laboratory prototype instrument designed for the automated measurement of radiation transmission and scattering through optical samples, is described. The system comprises two main components: the Optical Effects Module Enclosure (OEME) and the Optical Effects Module Electronic Controller and Processor (OEMCP). The OEM is designed for operation in the near UV at approximately 2540A, corresponding to the most intense spectral line activated by the mercury discharge lamp used for illumination. The radiation from this source is detected in transmission and reflection through a number of selectable samples. The basic objective of this operation is to monitor in real time the accretion of possible contamination on the surface of these samples. The optical samples are exposed outside of the OEME proper to define exposure conditions and to separate exposure and measurement environments. Changes in the transmissivity of the sample are attributable to surface contamination or to bulk effects due to radiation. Surface contamination will increase radiation scattering due to Rayleigh-Gans effect or to other phenomena, depending on the characteristics size of the particulate contaminants. Thus, also scattering from the samples becomes a part of the measurement program. Author

N76-18406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF SOME MINIATURE PRESSURE TRANSDUCERS SUBJECTED TO HIGH ROTATIONAL SPEEDS AND CENTRIPETAL ACCELERATIONS

Herbert L. Minkin 1976 10 p refs Proposed for presentation at 22nd Intern. Instr. Symp., San Diego, Calif., 25-27 May, 1976; sponsored by Instr. Soc. of Am.
(NASA-TM-X-71791; E-8643) Avail: NTIS HC $3.50

The performance characteristics of several miniature pressure transducers were determined at centripetal accelerations up to 11,200 g's at a rotational speed of 23,000 rpm. The variation in centripetal acceleration was produced by changing radial position of the transducer relative to the center of rotation. Residual zero outputs and transducer sensitivities were determined at 23, 000 rpm and compared with those determined at 0 rpm. The actual pressures at the various transducer locations differ from the center line impressed pressures due to a rotational effect. Corrections for this effect were made. A brief description of the test apparatus is included. Author

N76-18407*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.

ANALYTICAL AND EXPERIMENTAL EVALUATION OF TECHNIQUES FOR THE FABRICATION OF THERMOPLASTIC HOLOGRAM STORAGE DEVICES Final Report, 15 Mar.

1974 - 15 Dec. 1975
Jerry W. Rogers 15 Dec. 1975 24 p refs
(Contract NAS8-30618)
(NASA-CR-144202) Avail: NTIS HC $3.50 CSCL 14E

The results of an experimental investigation on recording information on thermoplastic are given. A description was given of a typical fabrication configuration, the recording sequence, and the samples which were examined. There are basically three configurations which can be used for the recording of information on thermoplastic. The most popular technique uses corona which furnishes free charge. The necessary energy for deformation is derived from a charge layer atop the thermoplastic. The other two techniques simply use a dc potential in place of the corona for deformation energy. Author

N76-18408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A NEW APPROACH TO THE PULSED THERMOCOUPLE FOR HIGH GAS TEMPERATURE MEASUREMENTS
George E. Glawe, Herbert A. Will, and Lloyd N. Krause 1976 13 p refs Proposed for presentation at 22nd Intern. Instr. Symp., San Diego, Calif., 25-27 May 1976; sponsored by Instr. Soc. of Am.
(NASA-TM-X-71883; E-8656) Avail: NTIS HC $3.50 CSCL 14B

Pulsed thermocouple systems can be used to measure gas temperatures above the melting point of the thermocouple by various techniques of short term of intermittent exposure of the thermocouple operating at lower temperatures. An approach is described which uses a thermocouple cooled by a small jet of inert gas. When a measurement is to be made, the cooling jet is turned off and the thermocouple allowed to heat up to near its melting point, at which time the cooling is reapplied. The final temperature which the thermocouple should have attained is then calculated by extrapolating an exponential curve fit to the data. Temperature measurements can be recorded and displayed in near real time by using modern high-speed computing systems to perform these calculations. Examples of the technique applied to high temperature jet engine combustor development are presented. Author

N76-18409*# Bowie State Coll., Md.
HOLOGRAPHIC GRATINGS FOR SPECTROGRAPHIC APPLICATIONS: STUDY OF ABERRATIONS Semiannual Status Report
Manjit S. Bhatia [1975] 7 p refs
(Grant NGR-21-027-010)
(NASA-CR-146316) Avail: NTIS HC $3.50 CSCL 14E

The design and fabrication of holographic gratings requires an understanding of Fermat's principle. This principle states that the path of a light ray from one point to another is that which requires the least time. The aberrant, optical path of an object point to an image was studied using Fermat principles. Author

N76-18410*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
SPECIAL-GEOMETRY PROPORTIONAL COUNTERS AND TECHNIQUES FOR DETECTION OF LOW-LEVELS OF X-RAYS AND BETA-PARTICLES Semiannual Progress Report, 1 Aug. 1975 - 1 Feb. 1976
John C. Gregory Feb. 1976 16 p refs
(Contract NAS8-31170)
(NASA-CR-144205; SAR-1976) Avail: NTIS HC $3.50 CSCL 14B

The use and sensitivity of the multiwire proportional counter to detect Kr-85 in ambient air are examined. Data also cover monitoring beta and X-ray emitting radio nuclides at low activity levels. Results show the counter to have excellent properties for monitoring Kr-85 down to 0.0004 pCi cu/cm. Author

N76-18411*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.
A HIGH-TEMPERATURE WIDEBAND PRESSURE TRANSDUCER Progress Report, Sep. 1975 - Mar. 1976
Allan J. Zuckerwar Mar. 1976 19 p refs
(Grant NsG-1039-1)
(NASA-CR-146422; PGSTR-PH76-24) Avail: NTIS HC $3.50 CSCL 14B

The problem of operating a condenser microphone as a terminal element of a half wavelength transmission line was dealt with; the environment in which the microphone operates necessitates a 25 foot separation from its supporting electronics. A theoretical analysis of the microphone-cable system, substantiated by laboratory tests, provided criteria to optimize system gain. Author

N76-18412# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ABSOLUTE THERMOELECTRIC DETECTORS OF RADIATION POWER
V. E. Kartashevskaya and L. F. Litvinova [1975] 19 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 295, 1973 p 160-171
(NRC/CNR-TT-1847) Avail: NTIS HC $3.50

The development of absolute detectors, bolometers and thermoelectric radiometers which work on the principle of substituting the thermal effect of electrical energy for that of radiation is considered. Performance characteristics of several detectors are compared along with various methods of energy measurement. Emphasis is placed on absolute thermoelectric detectors. J.M.S.

N76-18413*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A DEVICE FOR TENSIONING TEST SPECIMENS WITHIN AN HERMETICALLY SEALED CHAMBER Patent Application
Page K. Evans and Dan L. Shady, inventors (to NASA) (Sperry Rand Corp.) Filed 13 Feb. 1976 17 p
(NASA-Case-MFS-23281-1; US-Patent-Appl-SN-657995) Avail: NTIS HC $3.50 CSCL 14B

A device for tensioning test specimens within an hermetically sealed chamber is reported. The device is characterized by a support column adapted to be received within an insulated, hermetically sealable chamber, a plurality of anchor pins mounted on the column for releasibly connecting thereto a plurality of test specimens, a plurality of axially displaceable pull rods received by the column in coaxial alignment with the anchor pins. One end of each pull rod is being provided with a coupling for connecting the pull rod to a test specimen, while the opposite end of the pull rod is extended through a cover plate and adapted to be connected with a remotely related linear actuator through a connecting link including a load cell for measuring stresses as the pull rod is placed in tension by the actuator. NASA

N76-18414# Joint Publications Research Service, Arlington, Va.
INSTRUMENTS FOR GRAVITY DETERMINATION AT SEA AND THEIR ANALYSIS
Yu. D. Bulanzhe, ed. 19 Feb. 1976 109 p refs Transl. into ENGLISH from the book "Pribory dlya Opredeleniya Sily Tyazhesti na More i ikh Issledovaniye" Moscow, Izd. Nauka, 1966 p 1-160
(JPRS-66815) Avail: NTIS HC $5.50

The first automated Soviet marine gravimeter, the GAL-TsPAV, is briefly described. The results of its laboratory and ship studies are included. Author

N76-18415*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR DETERMINING THERMOPHYSICAL PROPERTIES OF TEST SPECIMENS Patent Application
Richard R. Corwin (Beta Industries, Inc.), Joseph S. Kramer (Beta Industries, Inc.), Theodore R. Creel, Jr., and Robert A. Jones, inventors (to NASA) Filed 27 Feb. 1976 9 p
(NASA-Case-LAR-11883-1; US-Patent-Appl-SN-662175) Avail: NTIS HC $3.50 CSCL 14B

Apparatus for directly measuring thermophysical properties of a test specimen such as a wind tunnel model is described. The test specimen and a reference specimen are simultaneously subjected to the heat from a heat source. A thermocouple is attached to the reference specimen for producing a first electrical analog signal proportional to the heat rate that the test specimen is subjected to, and an infrared radiometer that is aimed at the test specimen produces a second electrical analog signal proportional to the surface temperature of the test specimen.

An analog-to-digital converter converts the first and second electrical analog signals to digital signals. These digital signals are applied to a computer for calculating the thermophysical properties. NASA

N76-18416# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
NEW APPROACH TO ELECTRON SPECTROSCOPY
P. B. Woollam Mar. 1975 43 p refs
(RD/B/N-3309) Avail: ERDA Depository Libraries HC $5.25

A new approach to electron spectroscopy in reactor environments was considered with the aim of enabling in-situ measurements to be made in the presence of high gamma fluxes. A computer technique to analyze the resultant spectra was developed and used to study some hypothetical data. Magnetic techniques, telescope techniques, and pulse risetime techniques are studied. Author (NSA)

N76-18417# California Univ., Berkeley. Lawrence Berkeley Lab.
ACCURATE MEASUREMENTS OF NOISE PARAMETERS IN ULTRA-LOW NOISE OPTO-FEEDBACK SPECTROMETER SYSTEMS
May 1975 34 p refs Presented at 2nd ISPRA Nuclear Electronics Symp., Stresa, Italy, 20 May 1975
(Contract W-7405-eng-48)
(LBL-3671; CONF-750521-4) Avail: NTIS HC $4.75

The accurate measurement of the basic electronic noise parameters of ultra-low noise spectrometer systems was developed in the frequency domain by spectrum analysis. This method overcomes some of the difficulties experienced in using conventional techniques. An analytic and experimental comparison between time and frequency domain techniques was carried out and the use of the latter as a method to develop extremely low-noise detector and preamplifier packages is demonstrated. The origin of the remaining noise in high quality systems was traced to surface and gate junction generation through traps in the preamplifier. Author (NSA)

N76-18418# Perkin-Elmer Corp., Norwalk, Conn. Electro-Optical Div.
ADVANCED LOW ALTITUDE PANORAMIC CAMERA STUDY Final Technical Report, Jul. 1973 - Jun. 1974
Benne J. Troidle Aug. 1975 55 p
(Contract F33615-73-C-1203; AF Proj. 2004)
(AD-A016856; PE-TR-12070; AFAL-TR-75-121) Avail: NTIS CSCL 14/5

The report describes the results of a study investigating unique concepts to accomplish low altitude panoramic photography. The ultimate goal is to achieve tactical reconnaissance performance equivalent to that achievable today but with a minimal impact on vehicle weight/volume budgets. Two camera systems using quasi-panoramic scan techniques have been modeled and their attendant peculiarities analyzed. Both systems are sized for a 140 degree swath width and a 300 nautical mile flight line at 500 foot altitude. The performance predictions using Modulation Transfer Function techniques are within the guide lines established; i.e., nominally 0.3 milliradian per cycle. One system uses a conventional aerial photographic lens and achieves wide angle coverage by scanning about a vertical axis. The second system uses a unique monocentric lens design to achieve wide angle coverage in a strip camera mode. Since the lens is used in a slit configuration at a fixed field angle, normal degradation attributed to wide angle photography, i.e., distortion and illumination variation are negated. GRA

N76-18419# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N.Mex.
HOLLOW-SPHERICAL DIPOLE D-DOT SENSOR (HSD-4) DEVELOPMENT Final Report, 15 Aug. 1974 - 28 Feb. 1975
W. Reed Edgel Kirtland AFB, N. Mex. AFWL Aug. 1975 32 p refs
(Contract F29601-75-C-0014; AF Proj. 1088)
(AD-A014913; EG/G-AL-1147; AFWL-TR-75-77) Avail: NTIS CSCL 14/2

The report describes a hollow spherical dipole D-dot sensor (model HSD-4). It consists of two hemispherical conducting shells on opposite sides of a ground plate and produces a current output in response to a time-variant D-field perpendicular to the ground plate. The sensor is a scaled-down version of a larger hollow spherical dipole (model HSD-2), but with less sensitivity and higher frequency response. The theory of operation design, and construction of the sensor, and prototype testing and test results are discussed. GRA

N76-18420# Northeastern Univ., Boston, Mass. Dept. of Mechanical Engineering.
PROGRAM TIMER: MODEL 50
Richard L. Morin L. G. Hanscom Field, Mass. AFCRL Jun. 1975 28 p
(Contract F19628-73-C-0152; AF Proj. 7659)
(AD-A014845; AFCRL-TR-75-0328; SR-3) Avail: NTIS CSCL 14/2

Presented is a summary of the design and development of a digital program timer to meet the requirements of the current sounding rocket programs. The specific unit described is the Model 50, which meets all present design criteria. Modifications to this design can provide alternative performance specifications in the same package configuration as the Model 50. These options are described in this report. GRA

N76-18421# Whittaker Corp., North Hollywood, Calif. Shock Hydrodynamics Div.
INFRA RED TRANSMISSIBLE MATERIALS AS STRAIN GAGE IMPACT SENSORS Final Report
N. A. Louie and L. Zernow Oct. 1974 64 p refs
(Contract DAAA21-74-C-0361)
(AD-A014997) Avail: NTIS CSCL 16/4

The purpose of the work described in this report was to determine whether an effective impact sensor could be obtained without substantial deterioration of the I. R. transmission of the window from a very thin layer of metal or semi-conductor material applied to an I. R. transparent window (substrate). Such an impact sensor would be useful in providing a nose impact fuzing system for an infra-red guided missile where the infra-red window was located at the nose of the missile. GRA

N76-18422# Hughes Research Labs., Malibu, Calif.
HOLOGRAPHIC LENS FOR PILOTS HEAD-UP DISPLAY Final Report, 1 Jul. - 31 Oct. 1974
Donald H. Close, Anson Au, and Andrejs Graube 1 Apr. 1975 60 p refs
(Contract N62269-74-C-0642)
(AD-A015989; NADC-75044-30) Avail: NTIS CSCL 09/5

This report describes work on the development of a hologram recording apparatus with a fringe control system for 16 in. diameter, 50 degrees off-axis, symmetric transmission holographic lens for pilot's Head-Up Display (HUD). The basic HUD system parameters are a 25 degrees field of view, a 25 in. eye relief, and a 3 in. by 5 in. wide exit pupil. The hologram geometry was chosen based on parametric analysis and preliminary studies on several Hughes continuous reflection and transmission hologram lens designs of Phase 1, Contract N62269-73-C-0388, Holographic Lens for Pilot's Head-Up Display. The work also includes design of processing equipment for large holographic lens elements recorded on 18 in. x 18 in. dye-sensitized dichromated gelatin, holographic plates. 18 in. x 18 in. x 0.25 in. thick photographic plates were procured under this contract. GRA

N76-18177* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPLEMENTATION OF WIDEBAND DIGITAL RECORDING EQUIPMENT IN THE DSN
K. R. Kimball *In its* The Deep Space Network 15 Feb. 1976 p 96-104 (For availability see N76-18163 09-12)
CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-18423 Catholic Univ. of America, Washington, D.C.
MODE AND RECOMBINATION CONTROL IN SEMICON-

DUCTOR LASERS Ph.D. Thesis
Richard Raymond Shurtz, II 1975 225 p
Avail: Univ. Microfilms Order No. 76-3782

A self consistent mathematical description of a semiconductor GaAlAs heterostructure laser was developed. It includes excess hole and electron injection, diffusion, drift and recombination. The excess carrier motion is described by the ambipolar diffusion equation. The boundary conditions at each heterojunction are found by imposing electron and hole current continuity as well as quasi-Fermi level continuity. The effect of aluminum concentration on carrier mobility, effective mass and gap is included. The volume recombination rate is related to the optical gain of the laser in linear fashion using coefficients obtained by integrating over parabolic bands without quasi-momentum conservation. The recombination lifetime is found in a similar manner. The diffusion coefficients are calculated using the generalized Einstein equation. The dependence of the index of refraction in the device upon carrier injection is included. The E-M field is calculated by solving Maxwell's equations for a general five layer dielectric waveguide. Above threshold the gain is assumed to be pinned at the threshold value. For each solution, the E-M field distribution is determined self-consistently for a particular excess carrier distribution.
Dissert. Abstr.

N76-18424 Fordham Univ., New York.
HIGH RESOLUTION RAMAN SPECTRA OF GASES WITH LASER EXCITATION Ph.D. Thesis
Chiu-Hua Wallace Wang 1975 193 p
Avail: Univ. Microfilms Order No. 76-4170

With high-resolution apparatus, both the pure rotational and rotation-vibration Raman spectra of linear molecules CO2 and CS2 were examined. From the pure rotational spectra, the molecular constants B and D sub j for the vibrational ground and excited states are evaluated. From the study of the rotation-vibration bands of the Fermi diad the band origins, rotational and centrifugal distortion constants, and the separations between the unperturbed levels were determined. The rotational spectra of asymmetric tops trans-C2H2F2 and trans-C2H2Cl2 were also studied and the molecular constants for these molecules based on symmetric top theory are given. A discussion of the unresolved K-structure in the rotational Raman spectra of symmetric top molecules is presented and a method for deducing approximate values for the centrifugal distortion constant D sub jk from the observed spectrum is suggested.
Dissert. Abstr.

N76-18425 Arizona Univ., Tucson.
FLUCTUATION PHENOMENA IN QUANTUM OPTICS, A. THE CONSTRUCTION OF A CO2 TEA LASER, B. Ph.D. Thesis
Weng Wah Chow 1975 84 p
Avail: Univ. Microfilms Order No. 76-2537

The use of quantum beat phenomena to test neoclassical radiation theory (NCT) and quantum electrodynamics (QED) is proposed. For a beam foil type of experiment with atoms having one upper level and two closely spaced lowered levels (all coherently excited), NCT predicts the presence of quantum beats in the emitted radiation; beats are not expected in QED. QED predicts beats when many atoms are present, in agreement with recent photo-echo experiments. An experiment to test NCT and QED is suggested. Using the quantum noise operator approach, the power spectral density is calculated of a laser subjected to a symmetry-breaking injected signal. The resulting spectrum is sharpened. It is further noted that these considerations are potentially of interest in producing high intensity fields in small focal volumes. A high power CO2 TEA laser that was built for use in laser isotope separation experiments is described. This laser, whose output pulses are each of the order of a few Joules, will be used in studies concerning the laser enrichment of SF6 and the temporal behavior of hot electrons in InSb.
Dissert. Abstr.

N76-18426 North Carolina State Univ., Raleigh.
ANALYTICAL STUDY OF HIGH FLOW CO ELECTRIC DISCHARGE LASER SYSTEMS Ph.D. Thesis
Neill Stephen Smith 1975 118 p
Avail: Univ. Microfilms Order No. 76-2437

A self-consistent model for high flow CO-N2-He electric discharge laser systems with coincident optical and flow axes is presented. The model employs the multifluid conservation equations, an integral form of the threshold conditions for the lasing transitions, and the electron Boltzmann equation to describe the laser system. The resulting integro-differential system of equations is solved by an iterative numerical technique. The effects of composition, inlet temperature and pressure, total mass flow rate, mirror reflectivity, and input power on the maximum average small signal gain coefficients, the intensities of the lasing transitions, and the efficiency were examined. The results indicate that for a given input power, mirror reflectivity, and N2 fraction, the efficiency is increased by reducing the inlet temperature, increasing the flow velocity, and/or increasing the CO fraction. Transitions on the lower vibrational bands can be obtained at the expense of lower efficiencies by reducing the fraction of CO.
Dissert. Abstr.

N76-18427* National Aeronautics and Space Administration. Pasadena Office, Calif.
STARK-EFFECT MODULATION OF CO2 LASER WITH NH2D Patent
Alan R. Johnston (JPL) and Richard D. S. Melville, inventors (to NASA) (JPL) Issued 23 Apr. 1974 8 p Filed 6 Jul. 1972 Sponsored by NASA
(NASA-Case-NPO-11945-1; US-Patent-3,806,834; US-Patent-Appl-SN-269450; US-Patent-Class-332-7.51; US-Patent-Class-331-94.5; US-Patent-Class-350-150; US-Patent-Class-350-160; US-Patent-Class-423-352; US-Patent-Class-423-644) Avail: US Patent Office CSCL 20E

The molecular stark-effect in NH2D is used to modulate the 10.6 microns, P(20) line of a CO2 laser. A 25 cm cell external to the laser is filled with about equal parts of NH2 and ND3 to a total pressure between 2 and 10 torr. An equilibrium concentration of NH2D as high as 45 percent is rapidly achieved. The cell is biased with a dc field (3.8 + or - 0.1 KV/cm) and modulated with an ac signal of (about 20 V RMS). At a cell pressure of a 4 torr, a modulation depth of 40 percent is achieved.
Official Gazette of the U.S. Patent Office

N76-18428* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIFFUSED WAVEGUIDING CAPILLARY TUBE WITH DISTRIBUTED FEEDBACK FOR A GAS LASER Patent
Charles Elachi, inventor (to NASA) Issued 17 Feb. 1976 8 p Filed 17 Dec. 1974 Supersedes N75-15974 (13 - 07, p 0776) Sponsored by NASA
(NASA-Case-NPO-13544-1; US-Patent-3,939,439; US-Patent-Appl-SN-533555; US-Patent-Class-331-94.5C; US-Patent-Class-350-96WG) Avail: US Patent Office CSCL 20E

For use in a waveguide gas laser, a capillary tube of glass or ceramic has an inner surface defining a longitundinal capillary opening through which the laser gas flows. At least a portion of the inner surface is corrugated with corrugations or channels with a periodicity Lambda where Lambda = 1/2 Lambda, Lambda being the laser gas wavelength. The tube includes a diffused region extending outwardly from the opening. The diffused region of a depth d on the order of 1 Lambda to 3 Lambda acts as a waveguide for the waves, with the corrugations producing distributed feedback. The evanescent component of the waves traveling in the diffused region interact with the laser gas in the opening, gaining energy, and thereby amplifying the waves travelling in the diffused region, which exit the diffused region, surrounding the opening, as a beam of wavelength Lambda.
Official Gazette of the U.S. Patent Office

N76-18429*# ITT Gilfillan, Inc., Van Nuys, Calif.
AIRBORNE VISIBLE LASER OPTICAL COMMUNICATIONS PROGRAM (AVLOC) Final Report
John H. Ward Jan. 1975 503 p
(Contract NAS8-20629)
(NASA-CR-120720; Rept-6906) Avail: NTIS HC $12.75 CSCL 20E

The design, development, and operation of airborne and ground-based laser communications and laser radar hardware is described in support of the Airborne Visible Laser Optical Communication program. The major emphasis is placed on the

development of a highly flexible test bed for the evaluation of laser communications systems techniques and components in an operational environment. Author

N76-18430*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
WATER VAPOR LIDAR Final Report
R. Ellingson, T. McIlrath, G. Schwemmer, and T. D. Wilkerson Jan. 1976 89 p refs
(Grants NsG-1036; NsG-1156)
(NASA-CR-146340; BN-816) Avail: NTIS HC $5.00 CSCL 20E

The feasibility was studied of measuring atmospheric water vapor by means of a tunable lidar operated from the space shuttle. The specific method evaluated was differential absorption, a two-color method in which the atmospheric path of interest is traversed by two laser pulses. Results are reported. For individual titles, see N76-18431 through N76-18433.

N76-18431* Maryland Univ., College Park.
A SUMMARY OF METEOROLOGICAL REQUIREMENTS FOR WATER VAPOR DATA AND POSSIBLE SPACE SHUTTLE APPLICATIONS
In its Water Vapor Lidar Jan. 1976 p 4-22 (For availability see N76-18430 09-36)
CSCL 20E

The accuracy of water vapor measurement required by modelers and forecasters at a number of scales of motion is discussed. Direct and indirect methods for operational use in obtaining atmospheric water vapor data are reviewed along with meteorological applications of water vapor data obtained by a space shuttle laboratory lidar system. Author

N76-18432* Maryland Univ., College Park.
LIDAR SIMULATION
In its Water Vapor Lidar Jan. 1976 p 23-75 refs (For availability see N76-18430 09-36)
CSCL 20E

The feasibility of measuring atmospheric water vapor via orbital lidar is estimated. The calculation starts with laser radar equations representing backscatter with and without molecular line absorption; the magntidues of off-line backscatter are demonstrated. Extensive prior data on water line strengths are summarized to indicate the available sensitivity to water vapor concentration. Several lidar situations are considered starting with uniform and perturbed atmospheres at 0, 3, 10 and 20 kM (stratosphere) altitudes. These simulations are indicative of results to be obtained in ground truth measurements (ground-based and airborne). An approximate treatment of polar observations is also given. Vertical atmospheric soundings from orbit and from ground stations are calculated. Errors are discussed as regards their propagation through the lidar equation to render the measured water vapor concentration imprecise; conclusions are given as to required laser energy and feasible altitude resolution. Author

N76-18433* Maryland Univ., College Park.
EXPLORATORY LASER EXPERIMENTS
In its Water Vapor Lidar Jan. 1976 p 76-86 refs (For availability see N76-18430 09-36)
CSCL 20E

Experiments are described which were undertaken to explore the application of various dye laser methods for generating laser pulses which could be tuned over H2O absorption lines in the visible and near infrared. Specific topics discussed include: operation of a long pulse dye laser with a tunable, narrow band output at high energies near the 5915 A water vapor absorption bands; assembly and operation of a short duration dye laser near the 5915 A water vapor absorption bands; construction of a dye laser to be pumped to operate in the red and near infrared; and preliminary studies of the beam divergence of the output of the a laser-pumped system. Results are summarized. Author

N76-18434# Defence Research Establishment Valcartier (Quebec).
THE EFFECTS OF ATMOSPHERIC PROPAGATION ON LONG-RANGE APPLICATIONS OF LASERS (SEA LEVEL)
A. J. Beaulieu Dec. 1975 40 p refs
(Proj. 97-01-39)
(DREV-4030/75; CRDV-4030/75) Avail: NTIS HC $4.00

Using the best available data on atmospheric propagation at different wavelengths, the relative performance of ladar systems using 1.06-micrometer, 3.8-micrometers and 10.6-micrometers lasers was investigated under various conditions. It is shown that except under low visibility conditions the 3.8-micrometers systems have the best performance due to the low atmospheric absorption of this wavelength relative to 10.6 micrometers and the low aerosol attenuation relative to 1.06 micrometers. Lasers radiating at 3.8 micrometers with the most efficiency and power are the chemical DF and HCl lasers. Author

N76-18435*# Illinois Univ., Urbana. Radio Research Lab.
THE EFFECTS OF ATMOSPHERIC REFRACTION ON THE ACCURACY OF LASER RANGING SYSTEMS
D. L. Zanter, C. S. Gardner, and N. N. Rao Jan. 1976 151 p refs
(Grant NsG-5049)
(NASA-CR-146313; RRL-471; UILU-ENG-76-2538) Avail: NTIS HC $6.75 CSCL 20E

Correction formulas derived by Saastamoinen and Marini, and the ray traces through the refractivity profiles all assume a spherically symmetric refractivity profile. The errors introduced by this assumption were investigated by ray tracing through three-dimensional profiles. The results of this investigation indicate that the difference between ray traces through the spherically symmetric and three-dimensional profiles is approximately three centimeters at 10 deg and decreases to less than one half of a centimeter at 80 deg. If the accuracy desired in future laser ranging systems is less than a few centimeters, Saastamoinen and Marini's formulas must be altered to account for the fact that the refractivity profile is not spherically symmetric. Author

N76-18436*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATMOSPHERIC TRANSMISSION OF CO2 LASER RADIATION WITH APPLICATION TO LASER DOPPLER SYSTEMS
S. S. R. Murty 28 Nov. 1975 52 p refs
(NASA-TM-X-64987) Avail: NTIS HC $4.50 CSCL 20E

The molecular absorption coefficients of carbon dioxide, water vapor, and nitrous oxide are calculated at the P16, P18, P20, P22, and P24 lines of the CO2 laser for temperatures from 200 to 300 K and for pressures from 100 to 1100 mb. The temperature variation of the continuum absorption coefficient of water vapor is taken into account semi-empirically from Burch's data. The total absorption coefficient from the present calculations falls within + or - 20 percent of the results of McClatchey and Selby. The transmission loss which the CO2 pulsed laser Doppler system experiences was calculated for flight test conditions for the five P-lines. The total transmission loss is approximately 7 percent higher at the P16 line and 10 percent lower at the P24 line compared to the P20 line. Comparison of the CO2 laser with HF and DF laser transmission reveals the P2(8) line at 3.8 micrometers of the DF laser is much better from the transmission point of view for altitudes below 10 km. Author

N76-18437# Illinois Univ., Urbana.
A DIRECT NUCLEAR PUMPED NEON-NITROGEN LASER Ph.D. Thesis
Russell John DeYoung 1975 129 p refs Sponsored by ERDA
Avail: NTIS HC $6.00

A neutron-driven laser that utilizes a boron-10 coating, Ne-N2 gas, and provides a simultaneous output at 8629 and 9393 A in nitrogen was experimentally investigated. The experiment employed a quartz laser tube containing a 68-cm section of aluminum tubing, coated on the inner surface with boron-10. The cell was placed next to the core of the illinois TRIGA reactor such that thermal neutrons bombarding the boron coating caused emission of MeV alpha and Li-ions. These ions, in turn ionized and excited the lasing gas. Pressure and concentration studies were carried out by utilization of a vacuum system attached to the laser external to the reactor. Lasing occurred at pressures from 75 to 350-Torr Ne with partial pressures of N2 from 4-10m Torr. The lasing threshold was the lowest threshold of any nuclear pumped laser. Experiments with uranium-235 coated cylinders

were conducted and lasing again occurred ato 8629 and 9393 A in nitrogen. Author

N76-18438# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

PERFORMANCE OF XeF/KrF LASERS PUMPED BY FAST DISCHARGE

C. P. Wang 26 Feb. 1976 19 p refs
(ATR-76(8210)-3) Avail: NTIS HC $3.50

The output energy and pulse shape of XeF/KrF lasers pumped by fast discharges were measured at various gas compositions and total pressures. For the KrF laser, the maximum output was obtained in a gas mixture of He:Kr:NF3 = 100:5:0.2 at a total pressure of 700 Torr. The output energy density was 160 mJ/1, and the wall-plug efficiency was 0.06%. The peak power was 55 kW. For the XeF laser, the maximum output was obtained in a gas mixture of He:Xe:NF3 = 100:4:2 at a total pressure of 500 Torr. The peak output power was 1 MW. The output energy density was a factor of 10 higher, and the wall-plug efficiency was a factor of 2.5 higher than reported earlier. Author

N76-18439# California Univ., Livermore. Lawrence Livermore Lab.

PROSPECTS FOR TRIVALENT RARE-EARTH VAPOR LASERS

W. F. Krupke 25 Jul. 1975 14 p refs Presented at the 2d Summer Colloq. on Electron. Transition Lasers, Woods Hole, Mass., 17-19 Sep. 1975 Sponsored by ERDA
(UCRL-77033; Conf-750914-1) Avail: NTIS HC $4.00

The exceptionally high volatility of the rare earth transition-metal trihalides lend themselves for storing substantial amounts of electronic energy. This is illustrated for NDI3 and Nd-Al-Cl3 vapors for which half of the molecules have been optically pumped. The dynamic nature of these vapor systems is discussed including rotational, vibrational, and electronic degrees of freedom. Implications of the shielded nature of the 4f/sup n/electrons of the ground electronic configuration (optically active-chemically inactive) are surveyed. Allowed 4f yields 5d transitions as pump bands and ligand electronic structure are also discussed. NSA

N76-18440# California Univ., Livermore. Lawrence Livermore Lab.

STUDIES OF CALORIMETER ABSORBERS FOR CW AND PULSED CO2 LASERS

S. R. Gunn 1 Jul. 1975 15 p refs
(Contract W-7405-eng-48)
(UCRL-51854) Avail: NTIS HC $4.00

Solid and liquid absorbers, used in calorimeters to measure the power and energy of CW and pulsed CO2 lasers, were studied from 9.24 to 10.76 mu m (CW) and near 10.588 mu m (pulsed). The principal materials used were magnesium oxide, lithium fluoride, polystyrene, polytetrafluorethylene, carbon tetrachloride, and kerosene. Author (NSA)

N76-18441# California Univ., Livermore. Lawrence Livermore Lab.

STRESS IN HIGH ENERGY FLASH-LAMP ENVELOPES

D. B. Tuft 11 Mar. 1974 22 p refs
(Contract W-7405-eng-48)
(UCID-16861) Avail: NTIS HC $4.25

Failure of high energy flashtubes which are used to optically pump solid state lasers has become a critical factor in the operation of large laser systems which require large numbers of flashlamps for operation. Failures in flashlamps are generally catastrophic in nature and can cause damage to other critical laser components within the laser head as well as render the laser module inoperable. The extent thermal stress contributes to failure in flashlamps is discussed. Since experimental measurements of temperature or stress fields in a flashlamp envelope during the period of interest (the flashlamp pulse) are not practical, or at best would be extremely difficult, the approach will be from a purely analytical standpoint. Author (NSA)

N76-18442# Sandia Labs., Albuquerque, N.Mex.

MOLECULAR IODINE LASER NEAR 3400 A

A. K. Hays, J. M. Hoffman, and G. C. Tisone 1975 2 p refs Presented at the 2d Summer Colloq. on Electron. Transition Lasers, Woods Hole, Mass., 17-19 Sep. 1975 Sponsored By ERDA
(SAND-75-5701; Conf-750914-2) Avail: NTIS HC $4.00

The 3460 to 3015 A band system of I2 has recently come under investigation as a possible candidate for an electron-beam-initiated laser. The observation of laser oscillations on four separate vibrational bands in this band system is reported. Emission from the 3460 to 3015 A band system of I2 was observed when mixtures of AR and various molecules containing iodine (I2,HI, Ch3I, and CF3I) were irradiated with a high-energy electron beam. Attempts to produce an I2 laser near 3400 A using Ar/I2 mixtures were unsuccessful. Ar/HI mixtures were studied spectroscopically but were never placed in a laser cavity. Laser oscillations were observed in Ar/CH3I and Ar/CF3I mixtures. NSA

N76-18443# Sandia Labs., Albuquerque, N.Mex.

STUDIES OF RARE-GAS-HALOGEN MOLECULAR LASERS EXCITED BY AN ELECTRON BEAM

G. C. Tisone, A. K. Hays, and J. M. Hoffman 1975 6 p refs Presented at the 2d Summer Colloq. on Electron. Transition Lasers, Woods Hole, Mass., 17-19 Sep. 1975 Sponsored by ERDA
(SAND-75-5668; Conf-750914-3) Avail: NTIS HC $4.00

Emission from rare-gas-halogen molecules has recently been reported with the suggestion that these molecules are possible candidates for laser systems operating in the near ultraviolet. Laser action is reported for XeBr, XeCl, and XeF. The results of some preliminary studies of these molecules in electron-beam-excited laser systems are reported. In addition, laser action in the KrF molecule is observed. In the rare-gas-halogen laser systems investigated, the highest efficiencies and largest output energies are obtained from the KrF and XeF lasers. NSA

N76-18444# New Mexico State Univ., University Park. Dept. of Physics.

THE USE OF SIMPLE OBSERVABLES TO PREDICT INFRARED EXTINCTION COEFFICIENTS OF ATMOSPHERIC AEROSOLS Final Report, 1 Oct. 1974 - 30 Jun. 1975

G. H. Goedecke 16 Sep. 1975 30 p refs
(Grant DAHC04-75-G-0033)
(AD-A016174; ARO-12832.1-R-GS) Avail: NTIS CSCL 20/6

Several model aerosols of a given type, having the same visibility, but different yet reasonable microstructure, exhibit very wide dispersion, as much as 700%, in values of transmission at wavelengths from 2.0 to 10.6 micrometers. At near infrared wavelengths, from the visible to 2.0 micrometers, the dispersion is reduced, to a tolerable value of 10% at 1.06 micrometers. Two methods are suggested for exploiting the theoretical predictive techniques reported here. Results of a study designed to determine some of the effects of multiple scattering in low visibility situations (fog and a haze-soot mixture) indicate that laser system detectors of small solid angle register a transmission given very accurately by the single-scattering exponential transmission law, even for optical thickness greater than unity, but that detectors of large solid angle observe a considerably enhanced transmission for such optical depths. Also reported are results of two relevant but peripheral investigations, one concerning the application of dispersion relations to the complex reflectivity, the other concerning a necessary modification of radiative transfer theory under certain circumstances. GRA

N76-18445# Frankford Arsenal, Philadelphia, Pa.

LASER RANGEFINDING TECHNIQUES FOR HELICOPTER FIRE CONTROL APPLICATIONS. PHASE 1: HARDMOUNTED LASER CONCEPT Final Test Report, Oct. 1973 - Oct. 1974

Albert C. Cappiella Jan. 1975 37 p
(DA Proj. 1F2-63206-D-043)
(AD-A016165; FA-TR-75024) Avail: NTIS CSCL 19/5

The concept of hardmounting a laser rangefinder to a helicopter airframe and having the pilot obtain the range to target by pointing the aircraft, was evaluated. The overall results indicate that this technique produced range errors of approximately 10% over all altitudes (300 ft. to 2500 ft.). The evaluation showed the range error to increase significantly as operational altitude decreased. This was due to small angular pointing errors translating into large horizontal miss distances when small grazing angles are incurred. Range errors of 20-25% were projected at 50-100 ft. altitudes. It was also determined that last pulse

return logic produced smaller range errors than first pulse return logic. GRA

N76-18446# New Mexico State Univ., University Park. Dept. of Physics.
RESEARCH IN THE AREA OF ATMOSPHERIC MODELING: HIGH-RESOLUTION ATMOSPHERIC IR TRANSMITTANCE PREDICTION, PART 2 Interim Report, 1 Mar. 1974 - 30 Sep. 1974
August Miller, Robert L. Armstrong, Charles W. Welch, and Robert P. Sandoval Aug. 1975 48 p refs
(Contract DAAD07-73-C-0134; DA Proj. 1T1-61102-B-53A)
(AD-A016158) Avail: NTIS CSCL 20/6

The primary technological concern of the Target Signature Analysis (TSA) program is to locate, identify, and destroy stationary or moving ground targets through their infrared emission or reflective characteristics when viewed through low visibility atmospheric conditions. (The spectral band of interest is from 0.4 to 14 micrometers). The responsibility of the Atmospheric Sciences Laboratory (ASL) scientific group rests in the theoretical and empirical development of computerized models for the prediction of the attenuative effects of atmospheric scattering and absorption. The New Mexico State University (NMSU) scientific group is currently assisting this program with the investigation and testing of a computerized scattering model for predicting the attenuation of laser energy transmitted through atmospheric paths. In addition, they have previously assisted in reviewing and developing techniques for high resolution infrared transmittance in homogeneous atmospheres. GRA

N76-18447# Naval Weapons Center, China Lake, Calif.
WEAR-ULTRAVIOLET LASING DYES. PART 2. EFFECTS OF COAXIAL FLASHLAMP EXCITATION Technical Report, Jun. 1974 - Jun. 1975
Aaron N. Fletcher Sep. 1975 78 p refs
(AD-A016253; NWC-TP-5768-Pt-2) Avail: NTIS CSCL 20/6

Methodology of evaluating a series of laser dyes using coaxial xenon flashlamp excitation is described. Lasing wavelengths, total output energies, and time/energy relationships were measured. Effects of additives, window alignment, concentration of dye, cover gas, flash characteristics, flow rate of solution, frequency of flashes, and the solvent were evaluated. Effects of variation of chemical substituents are described in Part 1 of this report. GRA

N76-18448# Naval Research Lab., Washington, D.C.
ARPA/NRL X-RAY LASER PROGRAM Semiannual Technical Report, 1 Jan. - 30 Jun. 1975
Sep. 1975 173 p refs
(ARPA Order 2694; NRL Proj. NO1-43; NRL Proj. NOI-33)
(AD-A015872; NRL-MR-3130) Avail: NTIS CSCL 20/5

The ARPA/NRL X-ray laser program is concerned with demonstrating gain in the soft X-ray region. The program is jointly supported by ARPA and NRL. The approaches include electron-collisional pumping in picosecond laser pumped plasmas, resonant charge transfer pumping, optical parametric mixing to short wavelengths, traveling wave e-beam pumping, and analysis and numerical modeling. This report covers the progress made during the second half of FY-75. Author (GRA)

N76-18449# Maryland Univ., College Park. Dept. of Aerospace Engineering.
NAVIER-STOKES SOLUTIONS FOR CHEMICAL LASER FLOWS. PART 1: COLD FLOWS Interim Report
Ajay P. Kothari and John D. Anderson, Jr. Jun. 1975 51 p refs
(Grant AF-AFOSR-2575-74; AF Proj. 9750)
(AD-A015935; AE-75-6-Pt-1; AFOSR-75-1447TR) Avail: NTIS CSCL 20/5

This work is part of an overall effort to apply detailed and accurate computational fluid dynamic techniques to the solution of practical high energy laser flows. In particular, the complete Navier-Stokes equations are used to calculate the supersonic laminar mixing flows associated with HF chemical lasers. Multicomponent diffusion is treated in a detailed fashion. Solutions are obtained for 'cold flows', where the effects of chemical reactions and vibrational relaxation are not included. Although such a situation is purely artificial, the results do isolate some of the fluid dynamic aspects of chemical laser flows, and provide a set of data to be compared later with hot flow calculations. These results also lend encouragement that solving chemical laser flows by means of the complete Navier-Stokes equations is feasible. Finally, a set of numerical experiments using four different time-dependent finite-difference schemes show that relatively minor changes in the differencing procedure can lead to major variations in the results. A modification of the well-known MacCormack approach appears to be the best suited for mixing flows associated with chemical lasers. GRA

N76-18450# Riverside Research Inst., New York.
LASER CORRELOGRAPHY: TRANSMISSION OF HIGH-RESOLUTION OBJECT SIGNATURES THROUGH THE TURBULENT ATMOSPHERE
M. Elbaum, Marvin King, and M. Greenbaum 31 Oct. 1974 120 p refs
(Contract DAAH01-74-C-0419; ARPA Order 2281)
(AD-A013424; RRI-T-1/306-3-11) Avail: NTIS CSCL 20/5

A correlogram is the two-dimensional autocorrelation of the image of an object illuminated with non-coherent radiation. A laser correlogram is obtained from the power spectrum of the irradiance pattern scattered from the object when illuminated with sufficiently coherent radiation. The resolution of this signature is dictated by the size of the receiving aperture, with relatively minor degradation by atmospheric turbulence. This report collects in one place information which has been available up to now only in conference proceedings or in limited-circulation Research Notes of the Riverside Research Institute. The subjects treated analytically include: a model for laser backscattering, studies on the influence of atmospheric turbulence on the laser correlogram, statistical convergence properties of the laser correlogram signature, qualitative experimental laboratory results, and the outline of a design for a ruby-laser experiment using space objects. Author (GRA)

N76-18451# Alabama Univ., Huntsville. Dept. of Physics.
LOW LOSS WINDOW MATERIALS FOR CHEMICAL LASERS Semiannual Technical Report, 9 Jan. - 9 Jul. 1975
James A. Harrington Aug. 1975 55 p refs
(Contract DAAH01-74-C-0437; ARPA Order 2614)
(AD-A015587; UAH-RR-177) Avail: NTIS CSCL 20/6

The optical absorption has been measured at DF and HF wavelengths in a wide variety of materials which show promise for use as windows on high powered chemical lasers. These measurements, which were made using DF-HF chemical laser calorimetric techniques, are compiled in this report in an effort to bring together in a systematic fashion all the absorption data taken to date. The identification and characterization of surface absorption mechanisms such as those arising from organic solvents used in surface cleaning and from mechanical polishing, is a major thrust of this report. The specific materials studied in detail include ZnSe, SrF2, Ge, Si, NaF, CaF2, Yttralox and other miscellaneous alkali halides including NaCl, KCl, LiF, and KBr. GRA

N76-18171* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN OF A SUPERCONDUCTING CAVITY STABILIZED MASER OSCILLATOR
W. Higa *In its* The Deep Space Network 15 Feb. 1976 p 50-53 refs (For availability see N76-18163 09-12)
CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-18452 Houston Univ., Tex.
ELASTOHYDRODYNAMIC LUBRICATION OF OFFSET O-RING ROTARY SEAL Ph.D. Thesis
Manmohan Singh Kalsi 1975 150 p
Avail: Univ. Microfilms Order No. 76-3758

A fundamental research into the lubrication mechanism and operation of a seal for rotary shaft applications was conducted. The optical interference technique was successfully extended to

study the film profiles at the sealing interface by producing optically smooth elastomer seals. Elastohydrodynamic lubrication was found to exist over a wide range of operating conditions. A study of the other performance variables for the offset-seal define its useful application range to be between the packing-gland and face-seal. Hydrodynamic pressures were calculated using the finite element method. Results indicate the need to consider the departure of hydrodynamic pressures from static pressure distributions, in order to refine the inverse-hydrodynamic approach to predict seal operation. Dissert. Abstr.

N76-18453 Wisconsin Univ., Madison.
AIR VELOCITY MEASUREMENTS IN ENGINES BY VORTEX SHEDDING Ph.D. Thesis
Lee L. Chen 1975 336 p
Avail: Univ. Microfilms Order No. 75-23837

Air velocity measurement in internal combustion engines is complicated by the property variations during the rapid compression and expansion of the trapped mass, the contamination and vibration of the engine environment, and the turbulent and transient nature of the flow. Existing techniques of velocity measurement in engines, are reviewed and the application of Karman vortex shedding as a velocity sensor in a motored engine cylinder is described. The experimental results of Karman vortex shedding mechanism were surveyed with emphasis on the design of vortex shedding probe and the interpretation of measured data. The results indicate that the vortex shedding probe technique can be used for an engine where the shedding signal can be distinguished from free stream turbulence and its interaction with the wake. Any disturbance which is severe enough to disrupt the mechanism of vortex shedding will prevent the use of the vortices as a tracer. Dissert. Abstr.

N76-18454* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF PEENING AND PORTABLE PEENING GUN Patent
Vincent P. Caruso and Elbert J. Minter, inventors (to NASA) Issued 10 Feb. 1976 5 p Filed 6 Nov. 1974 Supersedes N75-10459 (13 - 01, p 0061)
(NASA-Case-MFS-23047-1; US-Patent-3,937,055; US-Patent-Appl-SN-521602; US-Patent-Class-73-399; US-Patent-Class-29-81D; US-Patent-Class-72-453; US-Patent-Class-173-132) Avail: US Patent Office CSCL 13H

An improved portable peening gun is reported that is characterized by a pneumatic motor, an axially reciprocable hammer supported to be driven by the motor from an initial position along a linear path, and an improved peening head including an axially reciprocable rod bundle co-axially aligned with the hammer and disposed within the path thereof. The improved head includes a plurality of peening rods, each being characterized by an anvil defined at one end thereof for receiving the hammer in impacting engagement, and a peening surface defined at the other end of a configuration substantially conforming to a segment of a sphere having a radius substantially equal to one half the thickness of the rod, a barrel for supporting the rod bundle for axial reciprocation, and a helical spring disposed within the barrel for urging the bundle in displacement toward its initial position. Official Gazette of the U.S. Patent Office

N76-18455* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
METHOD OF FLUXLESS BRAZING AND DIFFUSION BONDING OF ALUMINUM CONTAINING COMPONENTS Patent
Aleck B. Featherston (LTV Aerospace Corp., Dallas) and Kent P. OKelly, inventors (to NASA) (LTV Aerospace Corp., Dallas) Issued 10 Feb. 1976 6 p Filed 12 Mar. 1974 Supersedes N74-20071 (12 - 11, p 1297) Sponsored by NASA
(NASA-Case-MSC-14435-1; US-Patent-3,937,387; US-Patent-Appl-SN-450500; US-Patent-Class-228-193; US-Patent-Class-228-206; US-Patent-Class-228-214; US-Patent-Class-228-238) Avail: US Patent Office CSCL 13H

A method of diffusion bonding and fluxless brazing of aluminum containing components is reported. The aluminum surfaces are freed of any aluminum oxide coating and are coated with a polymeric sealer which can be thermally removed leaving essentially no residue. The polymeric sealer is being removed in a substantially oxygen free environment, and the aluminum components are then being brazed or diffusion bonded without the use of a flux to remove oxide coating.
Official Gazette of the U.S. Patent Office

N76-18456* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD AND APPARATUS FOR FLUFFING, SEPARATING, AND CLEANING FIBERS Patent
Dan Padilla, inventor (to NASA) (Martin-Marietta Corp., Denver) Issued 10 Feb. 1976 4 p Filed 12 Mar. 1974 Supersedes N74-20072 (12 - 11, p 1298) Sponsored by NASA
(NASA-Case-LAR-11224-1; US-Patent-3,937,661; US-Patent-Appl-SN-450502; US-Patent-Class-209-250; US-Patent-Class-19-205; US-Patent-Class-134-21; US-Patent-Class-134-37; US-Patent-Class-209-300; US-Patent-Class-209-305) Avail: US Patent Office CSCL 13I

A perforated tube is housed in a chamber in which vacuum is drawn. An air jet is directed into one end of the tube and fiber bundles are fed into the jet which separates and dispenses individual fibers from the bundle, fluffs them, cleanses them of any particulate material, and carries them into the tube. The tube retains the fibers while fiber fragments, undesirably short fibers and particulate matter are drawn by the vacuum and resultant air flow out of the tube through its perforations to a suitable discharge. Official Gazette of the U.S. Patent Office

N76-18457* National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR MINIMIZING INTERNAL COMBUSTION ENGINE POLLUTION EMISSION Patent
Jack H. Rupe, inventor (to NASA) (JPL) Issued 23 Sep. 1975 12 p Filed 10 Aug. 1973 Sponsored by NASA
(NASA-Case-NPO-13402-1; US-Patent-3,906,913; US-Patent-Appl-SN-387342; US-Patent-Class-123-121; US-Patent-Class-123-DIG.12; US-Patent-Class-123-119E; US-Patent-Class-123-120; US-Patent-Class-123-89a) Avail: US Patent Office CSCL 21A

A mixing device is provided for an internal combustion engine which simultaneously atomizes liquid fuel, mixes this fuel with an optimal quantity of hydrogen and combines this mixture with a prescribed quantity of air. A throttling mechanism controls the fuel delivery to the engine and also limits the fuel to air equivalence ratio to be predetermined upper bound to inhibit the production of air pollutants and to a lower bound which is above the lean flammability of the mixture.
Official Gazette of the U.S. Patent Office

N76-18458* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROCESS FOR MAKING ANHYDROUS METAL HALIDES Patent
Warren H. Philipp, Stanley J. Marsik, and Charles E. May, inventors (to NASA) Issued 17 Feb. 1976 5 p Filed 27 Nov. 1974 Supersedes N75-13053 (13 - 04, p 0396)
(NASA-Case-LEW-11860-1; US-Patent-3,939,048; US-Patent-Appl-SN-527728; US-Patent-Class-204-157.1H; US-Patent-Class-250-527) Avail: US Patent Office CSCL 13H

A process for the preparation and isolation of high purity anhydrous lower valence state metal halides is reported that dissolves the corresponding higher valence state metal halide in an organic liquid, which is selected such that the higher valence state metal halide is soluble therein and the lower valence state metal halide is insoluble therein. Subjecting the solution to high energy radiation reduces the higher valence state metal halide to its corresponding lower valence state metal halide, at a temperature in the range of from about 0 C to about room temperature. Official Gazette of the U.S. Patent Office

N76-18459* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AXIALLY AND RADIALLY CONTROLLABLE MAGNETIC BEARING Patent
Leo Veillette, inventor (to NASA) Issued 10 Feb. 1976 10 p Filed 8 Feb. 1974 Supersedes N74-18132 (12 - 09, p 1055)

(NASA-Case-GSC-11551-1; US-Patent-3,937,533; US-Patent-Appl-SN-440917; US-Patent-Class-308-10) Avail: US Patent Office CSCL 13I

An axially controllable magnetic bearing apparatus is described which provide 2 radial stiffness force control between a rotor and stator. The bearing is composed of a pair of axially spaced air gaps defined by corresponding pairs of annular pole pieces of the rotor and stator. Permanent magnets carried by the rotor generate constant axial bias fluxes in each of the air gaps. A pair of coils, disposed to axially excite the air gaps with variable flux, are driven in a manner so that the sum of the total fluxes in each of the air gaps is varied to change the radial stiffness between the bearing rotor and stator. Axial force between the rotor and stator is produced by exciting the two coils to vary the difference of the total air gap fluxes. The pair of coils are driven in a bridge circuit by pulse-width modulated signals. Official Gazette of the U.S. Patent Office

N76-18460*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HYDROGEN-RICH GAS GENERATOR Patent Application
John Houseman (JPL) and Donald J. Cerini, inventors (to NASA) (JPL) Filed 10 Jul. 1974 27 p Sponsored by NASA
(NASA-Case-NPO-13560; NASA-Case-NPO-13561-1; US-Patent-Appl-SN-487156) Avail: NTIS HC $4.00 CSCL 13F

A process and apparatus are described for producing hydrogen-rich gas from liquid hydrocarbon and air. The proposed gas generator is portable and produces soot-free hydrogen-rich gas preventing clogging of the carburetor of the internal combustion engine using the product gas. The use of water or steam in the process is eliminated. NASA

N76-18461# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
A DYNAMIC THEORY OF PISTON RING LUBRICATION: LOAD
S. Furuhama and M. Tsuruta 1976 24 p refs Transl. into ENGLISH from Nippon Kikai Gakki Rombunshu (Japan), v. 27, no. 178, 196 p 919-926
(NRC/CNR-TT-1849) Avail: NTIS HC $3.50

Theoretical and experimental investigations were made of added load effects on a running piston ring in terms of lubrication theory. The ratio of the pressure in the rubber tire to the pressure difference between the upper and lower sides of ring were obtained in order to equalize the lubricating properties. This ratio is influenced by the shape and thickness of the oil-film and also by the moving direction of the piston-ring however, the approximate value is 0.5 for all conditions. Author

N76-18462*# Academy of Sciences (USSR), Moscow.
ANALYSIS AND SYNTHESIS OF MECHANISMS
N. I. Levitskii, ed. 1975 400 p refs Transl. into ENGLISH of the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 400 p Sponsored by NASA and NSF
(NASA-TT-F-680; TT-71-58004) Avail: NTIS HC $10.75 CSCL 13I

The mechanics of steering linkages and cam movements are elaborated theoretically. For individual titles, see N76-18463 through N76-18494.

N76-18463* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
KINEMATIC ANALYSIS OF THE STEERING LINKAGE OF AN AUTOMOBILE
N. I. Aleksishvili *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 1-9 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 9 p (For availability see N76-18462 09-37)
CSCL 13I

Conditions of efficiency of the steering linkage of an automobile having 4 kinematic pairs of 5th class are investigated, taking into consideration the possible deviations and errors in the dimensions of links of the linkage. A method for compensating for manufacturing or assembly errors of an automobile steering linkage by maintaining a prescribed clearance allowance in the turning pairs is proposed. A relationship is derived, which makes it possible to calculate the amount of clearance necessary to compensate for the deviations in the dimensions of the links of the steering mechanism of an automobile. Equations and procedures of calculation are intended to serve as an algorithm for solving the given problem with the help of digital computers. Author

N76-18464* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
NEW METHODS OF SYNTHESIS OF MECHANISMS FOR REPRODUCING AND ENVELOPING CURVES
E. G. Berger *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 10-20 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

The proposed methods of synthesis of mechanisms are based on the theory of enveloping and the generalized transformation of curves. A curve is considered as enveloping a set of straight lines, constrained by definite geometrical conditions. The analysis gives proofs of three theorems. On the basis of these methods, mechanisms for formation of sheet of Descartes and lemniscates of Bernoulli with the simultaneous enveloping of hyperbola and cubic parabola have been found and also for the formation and enveloping of conical sections, enveloping of quadratic and semicubical parabolas and others. Author

N76-18465* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DETERMINATION OF MOMENTUM IN THREE-LINK MECHANISMS WITH A HIGHER PAIR OF THE 4TH CLASS
L. N. Borisenko *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 21-30 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 10 p (For availability see N76-18462 09-37)
CSCL 13I

Motion of a plane with respect to a point has been considered. During selection of motion of the plane, curves appear to be centroids in relative motion, while the curvature of curves are same at their point of contact. In addition the diameter of the rotating circle and both the parameters of the curve of circular points in the relative motion have been found. For the three link mechanism, an inversion has been carried out in such a way, that driving link 1 becomes a support and profiles of the driving and driven links are conjugated roulettes. A moving system of coordinates connected with the plane has been specified, and diagrams of velocities, accelerations and angular momentum are drawn successively. Examples illustrating determination of the angular momentum in plane cam mechanisms are presented. Author

N76-18466* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
A METHOD OF CALCULATING THE CHANGE IN PRIMARY DIMENSIONS OF MECHANISMS DUE TO WEAR FOR THE PURPOSE OF ESTIMATING THEIR RELIABILITY
E. I. Vorobev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 31-40 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 10 p (For availability see N76-18462 09-37)
CSCL 13I

Change in tolerances of cam mechanism with the reciprocating follower have been determined by a method of calculation which takes into account abrasive and fatigue wear. Equations for the determination of accidental loads of driven link of the mechanism have been obtained which can be used for evaluating the reliability of these mechanisms. Author

N76-18467* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
CALCULATION OF KINEMATIC PARAMETERS OF RADIAL-PISTON MULTIPASS HYDRAULIC MOTORS WITH GUIDE BLOCK PROFILE CONSISTING OF ARCS OF CIRCLES
A. S. Gelman, Yu. A. Danilov, L. V. Krymova, and A. M. Makeev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 41-51 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

Problems of kinematics of radial piston multipass hydraulic motors with guide block profile determined by normal and tangential components of absolute velocity and acceleration of the piston group of hydraulic motors are considered in this article.

Motion of the roller on the convex, concave, linear and concentric parts of the profile has been considered. Introduction of the transitional parameter-pressure angle has made it possible to simplify the analytical expressions considerably and to express these in a form, suitable for engineering practice. Effect of the angular acceleration of the shaft on the amount of linear acceleration of piston group has been considered. Results have been generalized and put in a tabular form. An example is presented. Author

N76-18468* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
NOMOGRAPHS FOR SELECTING OPTIMAL LAWS OF MOTION OF DRIVEN LINKS OF CAM MECHANISMS
M. M. Gernet *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 52-59 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 8 p (For availability see N76-18462 09-37)
CSCL 13I

Equations for selecting the optimum motion have been derived and nomographs drawn for determining relative duration of starting up (acceleration) u, and the positions of the center of gravity of the areas of accelerations lambda sub 1 and lambda sub 2 for motion with double portion tachograms as per the given maximum velocity, for motions with three section tachograms; for determining relative duration of uniform motion according to a given maximum velocity, for determining the relative duration of start up u and the positions of the center of gravity of the graphs cf accelerations in case of lambda sub 1 = lambda sub 2 = lambda, for laws with double section tachograms, for laws of motion with three section tachograms and for direct and inverse relationship of the maximum accelerations, maximum velocity and relative duration of start up. Author

N76-18469* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DESIGN OF A FOUR-LINK MECHANISM FOR REPRODUCING A GIVEN MOTION
N. M. Guseinov and S. I. Gamrekeli *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 60-70 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

Problems connected with the design of plane hinged four link mechanisms for a given law of motion have been examined. Modeling of four link hinged mechanisms makes it possible to form all possible variants of contours of the four link mechanisms, and investigate these by varying the parameters. From these investigations, a conclusion can be made. Mechanical variation and selection of parameters for the given conditions simplify the problem of the designer and scientists who have to spend considerable time on the design of plane four link mechanisms. Author

N76-18470* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
SYNTHESIS OF CAM LEVER MECHANISMS FOR DIFFERENT TYPES OF MOTIONS OF DRIVEN LINKS
R. P. Dzhavakhyan *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 71-87 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 17 p (For availability see N76-18462 09-37)
CSCL 13I

The problem of synthesis of five link lever cam mechanisms, in which it is possible to regulate (both at rest and during motion) the stroke and phases of motion of the driven link, independently or according to a functional relationship, is investigated in this article. Variation of parameters of motion of the driven link for a fixed profile of the cam is accomplished by varying the parameters of the four link lever mechanism, which drives the cam into nonuniform motion or by varying the relative position of the cam and link. Author

N76-18471* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
EFFECTS OF ERRORS IN THE WORKING PROFILE OF THE CAM ON VELOCITY AND ACCELERATION OF THE FOLLOWER
E. N. Dokuchaeva *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 88-101 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 14 p (For availability see N76-18462 09-37)
CSCL 13I

The effect of dimensional errors in the working profile of the cam on the law of motion of the roller follower (without the consideration of its elasticity) has been analyzed. Irregularities on both smooth surfaces as well as surface with sharp turnings have been investigated. Analytical expressions for the additional velocity and acceleration of the follower depending on the geometrical form of errors of the design profile and values of the radii of the roller of the follower have been determined. The article describes methods to determine the optimum value of the radius of the roller of the follower and how to increase or decrease it. Author

N76-18472* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
KINEMATIC STUDY OF SPATIAL MECHANISMS BY THE TECHNIQUE OF VECTOR ANALYSIS
Yu. M. Zingerman *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 102-111 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 10 p (For availability see N76-18462 09-37)
CSCL 13I

For the kinematic analysis of a rigid body, 6 vector projections of each basic vector must be known. If two links of the spatial mechanism are connected to form a kinematic pair, for transition from link to link, a number of vector projections equal to the number of degrees of freedom for relative motion of these links is lost. The problem of determination of common vector projections of basic kinematic vectors, during the analysis of relative motion of two links forming the given pair is solved, for eight commonly used kinematic pairs. Rules established in this paper have been applied for the kinematic analysis of a number of spatial mechanisms. Author

N76-18473* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
A METHOD OF ANALYTICAL SYNTHESIS OF PLANE TOOTHED LEVER MECHANISMS
V. S. Karelin *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 112-131 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 20 p (For availability see N76-18462 09-37)
CSCL 13I

Connecting equations of points of the given curve form the basis of synthesis given in this paper. These equations can be written in a matrix form which is denoted as the Vandermond type of determinant. Exploring the properties of this determinant, three theorems have been proposed to simplify considerably the synthesis and exclude the differences between the methods of approximation for simple and multiple interpolation of sub-assemblies. Similarly a theorem has been proposed which shows that deviation of the limiting curve from the given curve is maximum out of all possible deviations in the given interval of approximation. The method of analytical synthesis of the plane epicyclic mechanisms considerably simplifies the syntheses of mechanisms which are approximately directed along the straight line of a curve of second order. Author

N76-18474* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
TWO SIMPLE METHODS OF REGULATING MOTION OF THE DRIVEN LINK IN THREE-DIMENSIONAL SINGLE CONTOUR MECHANISMS
A. A. Kasamanyan *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 132-142 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

Regulation by rearrangement of the driving or driven link around its fixed axis is considered. In order to accomplish regulation during motion, a diagram of the mechanism with the number of degrees of freedom more than one is taken. The selected methods of regulation are illustrated through examples of simplest mechanisms, in which driving and driven links are those links which belong to the support and form a cylindrical pair with it. A case is given, when it is expeditious to use the spatial regulating mechanism instead of a plane regulating one. Author

N76-18475* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
SYNTHESIS OF A TOOTHED LEVER TRANSMISSION

MECHANISM

A. E. Kropp *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 143-151 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 9 p (For availability see N76-18462 09-37)
CSCL 13I

A toothed lever transmission mechanism is described here, which allows to change smoothly the velocity and torque on the driving shaft of the actuating machine under load without the use of any sort of frictional devices. It is shown that the necessary relationship between the transmission ratio of the mechanism and the position of the regulating part may be obtained over a wide range. In particular, this property is used for obtaining the ideal pulling characteristic of the transporting machine. Under normal operating conditions, when the transmission mechanism is not decelerating, design relationships for the synthesis of four link basic mechanisms are stated for a given mean transmission ratio, as well as for the variable mean transmission ratio. For the range of operations analyzed for the transmission mechanism, the equations for the calculation of velocities and accelerations of its driven links are given. Author

N76-18476* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DESIGN OF THREE DIMENSIONAL FOUR-LINK MECHANISMS CONFORMING TO THE TRAVEL OF THE DRIVEN LINK AND COEFFICIENT OF INCREASE IN VELOCITY OF THE REVERSE STROKE

V. I. Kulyugin *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 152-162 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

Graphical and analytical methods of solving some problems of synthesis of the spatial crank-rocker mechanism of a general type conforming to a prescribed travel of the driven link and coefficient of increase of the velocity of reverse stroke, are presented in this paper. In addition, the method of drawing the fields of possible location of the center of the hinge connecting crank with the connecting rod, which considerably facilitates the selection of location of the center of the hinge and fulfills not only the geometric but also the kinematic conditions of the problem, has also been given. Author

N76-18477* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
CLASSIFICATION OF SLOTTED BAR AND LEVER MECHANISMS OF DISCONTINUOUS MOTION

P. G. Kukharenko *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 162-179 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 17 p (For availability see N76-18462 09-37)
CSCL 13I

Necessary and sufficient conditions of motion, instantaneous stop and dwell of links in the slotted bar-lever mechanisms have been analyzed. Equations for the determination of coordinates of the profile of the linear rocker have been derived and peculiarities of the method of synthesis of mechanisms with curvilinear profile of the driven link have been shown. A classification of 38 single position and multiple position mechanisms is given and displacement functions of some mechanisms with reciprocating, rocking and rotary motions of the driven link have been found out. These mechanisms make it possible to have the desired law of motion, and also vary the ratio of the duration of motion to the duration of stopping over a wide range and can be synthesized for realizing regulated dwell. Author

N76-18478* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
PECULIARITIES OF THE LAGRANGIAN METHOD IN THE SYNTHESIS OF MECHANISMS

N. I. Levitskii and Yu. L. Sarkisyan *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 180-187 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 8 p (For availability see N76-18462 09-37)
CSCL 13I

Integral expressions of Lagrangian multiples have been obtained on the basis of well known theorem about mean values. These expressions make it possible to make use of their equality to zero with sufficient accuracy, thus leading to the linearization of the nonlinear systems mentioned here. An important property for the quadratic synthesis of the hinged mechanisms has been established: conditions of minimum quadratic integral with some approximation, do not depend on equations of constraints, to which the nonlinear members of the approximation polynomials are subjected. Approximate simultaneous systems of linear equations whose number is equal to the number of unknowns and of nonlinear equations of constraints have been obtained. A method for solving the heterogeneous and homogeneous systems of equations for quadratic synthesis of mechanisms is given. Examples of calculations of 4 and 5 parameters of the four link mechanism for reproducing the logarithmic function are given. Author

N76-18479* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DESIGN OF CAM ELEMENTS OF ELECTRICAL SWITCHES

D. M. Lukichev, V. A. Nikonorov, and Z. S. Gazizova *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 188-195 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 8 p (For availability see N76-18462 09-37)
CSCL 13I

Equations for determining parameters of the cam element and its kinematic diagram are given. Similar calculations for the spring have been undertaken based on the condition of providing normal working of the contactor (switch). Besides electrical wear, mechanical wear has great significance for the contactors operating at small values of current. The consideration of wear of contacts and in kinematic pairs, during design of the pitch curve of the cam plate has also been made. Author

N76-18480* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
SYNTHESIS OF CAM-PLANETARY-CONNECTING ROD MECHANISM WITH REVERSE STROKE AND STOP

L. B. Maisyuk *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 196-206 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

Synthesis of a cam-planetary-connecting rod mechanism with complex single sided motion is analyzed by considering the maximum torque on the driving link of the mechanism. Conditions for selecting an optimal group of mechanisms with minimum values of the coefficient of maximum velocity of the follower, have been obtained. Equations for calculating the transitional sections of displacement function from motion to dwell and from dwell to motion are derived, so as to eliminate hard impacts on the driven link. Analytical relationships for calculating the displacement of the follower of the inversed cam group, contained in the combined mechanism have been found out. Equations in explicit form for the calculation of analogs of velocity and acceleration of the follower have been obtained. Method of calculation of cam-planetary-connecting rod mechanism has been given and an example of calculation of its parameters is also included. Author

N76-18481* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DETERMINATION OF THE ZONES OF EXISTENCE OF SLOTTED LEVER MECHANISMS

V. A. Mamedov *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 207-212 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 6 p (For availability see N76-18462 09-37)
CSCL 13I

A method for determining the boundaries of the zone of existence of slotted lever mechanism has been considered. A flow diagram and a computer program for the calculation of basic parameters of the mechanism in the universal algorithmic language ALGOL-60 is also given. These calculations can be used for solving other problems of synthesis of such mechanisms. Results show that for determining limiting values of angle of rotation, corresponding to the condition that discriminant is equal to zero, a cubical equation of cos alpha is obtained, which determines the boundary of the zone of existence as per the condition that discriminant is equal to zero. Author

N76-18482* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
THREE-DIMENSIONAL FIVE-LINK HINGED MECHANISMS

P. G. Mudrov *In its* Analysis and Syn. of Mech. (NASA-TT-F-680)

1975 p 213-219 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 7 p (For availability see N76-18462 09-37)
CSCL 13I

A hinged five link spatial mechanism is formed by the combination of two mechanisms. Geometrical parameters of the five link mechanism may easily be determined proceeding from the structures of combined Bennett mechanisms. The kinematics of the five link mechanism may also be determined depending on the method of their formation. Equations are formulated for the determination of position, velocity and acceleration of the driven link. An analysis of the equations for the calculation of angular velocity of the driven link made it possible to determine the conditions, for which it is possible to obtain a five link mechanism with two cranks, in which one crank performs two rotations for one rotation of the other; and a five link mechanism with one crank and one balancer where the stroke of the balancer (angle of rotation) may exceed 180 deg. Author

N76-18483* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
KINEMATIC STUDY OF THREE-DIMENSIONAL THREE-LINK LEVER MECHANISMS USING ANALYTICAL METHODS
Z. S. Natsvlishvili *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 220-232 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 13 p (For availability see N76-18462 09-37)
CSCL 13I

Relationships between kinematic parameters of three-link mechanisms of zero family with such modification as common in machine building and instrumentation have been established in the present study. Equations have been derived for the functional relationship of displacements, velocities, accelerations, relative velocities and accelerations, and angular velocities and accelerations of driven links with the angles of rotation of the driving links. From the results, tables have been developed and corresponding kinematic diagrams have been drawn, which provide insight into the motion of different links of the mechanisms.
Author

N76-18484* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
AN APPROXIMATE METHOD FOR SYNTHESIZING A HINGED LEVER AMPLIFYING MECHANISM OF A MOLDING PRESS
M. S. Rozovskii, E. N. Dokuchaeva, and V. G. Lapteva *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 233-245 Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 13 p (For availability see N76-18462 09-37)
CSCL 13I

Synthesis of the amplifying mechanism of a press for molding models is considered. The kinematic diagram of this mechanism differs from ordinary diagrams of amplifying mechanisms with a 'bending' lever in that during the working part of the stroke of the driven link of the mechanism, a nearly constant transmission ratio is provided. The problem includes the determination of dimensions of the six-link mechanism-seven parameters. For solving this problem, the accurate but complex relationship between the transmission ratio and parameters of the mechanism is replaced by an approximate relationship which is a complete third degree polynomial of the angle of rotation of one of the connecting rods. Introduction of two conditions of optimization made it possible to obtain simple approximate relationships for the determination of all seven unknown parameters of the mechanism, which made it possible to solve the problem of its synthesis. Author

N76-18485* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DYNAMIC FORCE ANALYSIS OF PLANE-MECHANISMS IN THREE-DIMENSIONAL SPACE
K. F. Sasskii *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 246-261 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 16 p (For availability see N76-18462 09-37)
CSCL 13I

An effort is made to consider the statics of plane Assur groups from the three dimensional point of view. For solving the problem, a method of initial parameters in matrix form is used. Basic equations are derived after providing the physical conception of the method. Kinematic parameters (linear and angular displacements) of any section of the spatial bar type linkage and force factors are expressed in terms of these parameters of the initial section. General matrix relationships obtained for any spatial bar type linkage have been used for the double carrier Assur group of the first type and a method for determining fifteen components of reactions in three turning pairs is derived. The problem of accuracy of position of this group is solved by considering the elastic deformation of its links. Author

N76-18486* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
ANALYSIS OF THE STRUCTURAL AND THE TECHNICAL ERRORS OF SIX-LINK MECHANISMS IN THE DWELL ZONE
V. I. Sergeev, S. A. Cherkudinov, and I. G. Oleinik *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 262-276 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 15 p (For availability see N76-18462 09-37)
CSCL 13I

Rational design of the modern machines is possible only through the calculation of structural and kinematic errors. Methods for the determination of structural errors of a six link mechanism and of kinematic error due to errors of lengths and clearances are considered here. Results provide guidelines for the selection of tolerances on lengths and clearances in the elements of the mechanisms. A comparative analysis of the structural and kinematic errors of mechanisms has been undertaken. Author

N76-18487* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
FUNDAMENTALS OF THE THEORY OF DYNAMIC SYNTHESIS OF CAM MECHANISMS
P. V. Sergeev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 277-283 ref Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 7 p (For availability see N76-18462 09-37)
CSCL 13I

Mathematical techniques for the dynamic synthesis of cam mechanisms for different dynamic conditions have been presented in this article. It has been shown that this problem leads to the selection of design parameters of cam mechanism whose extreme and limiting values for the given dynamic conditions coincide. This problem involves the selection of parameters of functions for their extreme values, which is equivalent to the classical problem of finding the extreme values of the function. For solving the problem of synthesis of parameters of the function it is proposed to use the auxiliary function, whose properties are established by the theorem, which is formulated and proved for the most general case. It is shown that the determination of parameter of initial function for the given value of its extreme leads to the determination of extreme value of the auxiliary function. The proposed method of dynamic synthesis is independent of design conditions and is universally applicable to any structural diagrams of plane and spatial cam mechanisms with one and two degrees of freedom. Author

N76-18488* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
KINEMATIC AND FORCE ANALYSIS OF SPATIAL MECHANISM OF PNEUMATIC AND HYDRAULIC DRIVE FOR STOPCOCKS OF GAS MAINS OF TYPE DU 1000
A. V. Sinev, I. Z. Brodotskaya, and I. S. Charnaya *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 284-295 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 12 p (For availability see N76-18462 09-37)
CSCL 13I

The problem of determination of forces in the links of mechanisms taking into account friction forces is solved in order to identify the zone of jamming and determine the loss due to friction. Force analysis of the mechanism is carried out by forming generalized spiral equations of equilibrium (by equating to zero the main vector of forces and moments for each link of the mechanism taking into consideration the mutual reactions in links and the frictional forces caused during the relative motion of links). The spiral calculations made it possible to effectively determine the position of links in space and their relative motion.

A method for calculating the forces in links of the mechanism considering friction forces has been developed. Author

N76-18489* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
DESIGN OF AUTOMATS WITH PHOTOELECTRONIC DEVICES FOR THE CONTROL AND MEASUREMENT OF LINEAR DIMENSIONS AND AREAS
B. N. Sklyadnevy, B. N. Yurukhin, Yu. I. Evteev, and E. I. Astakhov *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 296-308 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 13 p (For availability see N76-18462 09-37)
CSCL 13I

The selection of basic parameters of automats of specified efficiency and accuracy is considered. A comparative evaluation of different kinematic diagrams of automats has been undertaken. An example considering primary errors of the device is given. Results may be used in the design of automats with photoelectronic devices for the control and measurement of different geometrical parameters. Author

N76-18490* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
A NOMOGRAPHICAL METHOD FOR THE SYNTHESIS OF MULTIPLE CONTOUR PLANE HINGED-LEVER MECHANISMS
L. P. Storozhev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 309-322 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 14 p (For availability see N76-18462 09-37)
CSCL 13I

All plane slider-crank mechanisms are divided into three groups, depending on the dimensions of links and characteristic motion of links. The zone of existence of each group and of whole mechanism is determined analytically and graphically. Limiting slider-crank mechanism of 5 types correspond to the limits of these zones. This systematization define 8 slider crank mechanisms with different dimensions, which have different graphs of displacement functions and velocities. Five charts of displacement functions and one chart of absolute and relative linear velocities are constructed from graphs in the article. A number of kinematic and dynamic properties of this mechanism have been established by a study of these charts. Author

N76-18491* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
TECHNIQUES FOR SYNTHESIZING ADJUSTABLE LEVER MECHANISMS
B. S. Sunkuev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 323-333 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 11 p (For availability see N76-18462 09-37)
CSCL 13I

A method of synthesizing adjustable lever transmission for a specified variation in the extreme positions of the driven link and corresponding position of the driving link is described. The latter have been termed as phases of extreme positions of the driven link. The essence of the method is that adjustable mechanisms may be converted into an auxiliary nonadjustable one, which simulates the regulation of the original mechanism. Synthesis of the nonadjustable auxiliary mechanism is carried out initially. This is converted into the adjustable mechanism and parameters of the latter are determined. Author

N76-18492* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
AN APPROXIMATE TECHNIQUE FOR THE SYNTHESIS OF DISK CAM MECHANISMS
K. V. Tir and D. N. Senik *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 334-348 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 15 p (For availability see N76-18462 09-37)
CSCL 13I

Change in pressure angle during a kinematic cycle according to the four laws of motion has been studied in this article for 240 structural diagrams. For diagrams not included in this set, graphs of maximum pressure angles have been obtained by interpolation. Nomographs for selecting cam dimensions and instantaneous efficiency as a function of the given conditions have also been drawn. All generalizations have been made on the basis of the method of similarity invariants for the mechanisms. This makes it possible to draw charts of blocking contour for central cam mechanisms with reciprocating and oscillating followers which are valid for any law of motion under any conditions of loading of the mechanism. These charts take into account the necessary conditions for preventing jamming of the mechanism, the tensile strength and wear resistance of elements of components and also conditions of proximity which put limitations on the selection of the structural diagram. Author

N76-18493* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
THE PROBLEM OF EXISTENCE OF THE CRANK IN THE SPATIAL FOUR-LINK MECHANISM WITH TWO TURNING AND TWO SPHERICAL PAIRS
K. A. Tonoyan *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 349-365 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 17 p (For availability see N76-18462 09-37)
CSCL 13I

Geometrical conditions of turning of links of spatial four link mechanism with two spherical and two turning pairs have been considered. Conditions have been defined which permit the separation of the field of existence of double crank mechanisms from crank rocker mechanisms and point out the link in the definite zone of variation of parameters of the mechanism, in which it can be a crank. Analytical and graphical calculations for the limits of variation of the length of the connecting rod necessary for the existence of crank and mechanism are given. Conditions of turning of links have been obtained for one particular case and these conditions resemble Grasgaf's conditions for plane hinged four link mechanism. Author

N76-18494* Amerind Publishing Co. Pvt. Ltd., New Delhi (India).
FUNCTIONS WITH MINIMUM DEVIATIONS FROM ZERO IN PROBLEMS OF SYNTHESIS OF CAM MECHANISMS
Yu. V. Epshtein and V. A. Novgorodtsev *In its* Analysis and Syn. of Mech. (NASA-TT-F-680) 1975 p 366-377 refs Transl. into ENGLISH from the book "Analiz i Sintez Mekhanizmov" Moscow, Nauka, 1970 12 p (For availability see N76-18462 09-37)
CSCL 13I

During synthesis of cam mechanisms, functions with minimum deviation from zero are used. An algorithm for defining a polynomial or a function having minimum deviation from zero has been developed for calculating the polynomial. The algorithm has been programmed for a digital computer. A unit mass system, dynamically equivalent to the cam mechanism is considered. Experiments were undertaken on a special stand provided with a cam mechanism, for determining the effect of manufacturing errors on the optimal profile of a cam. Author

N76-18495# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
SYSTEMATIC FATIGUE INVESTIGATION OF HIGHER STRENGTH FINE-GRAIN STRUCTURAL STEELS IN WELDED CONDITION
Erwin Haibach and Rainer Olivier [1975] 7 p refs Repr. from Maschinenschaden (Munich), v. 48, no. 3, 1975 p 91-95 In GERMAN; ENGLISH summary
(JCAF-791) Avail: NTIS HC $3.50

For clearing up the divergencies existing in available national and international design rules on fatigue loaded welded joints, a common investigation was carried out under participation of seven laboratories and three welding institutes in five countries of the European community. Results obtained by means of statistical test plans produce a high reliability. The scatter scarcely exceeds the data to be expected when welding in one institute and testing in one laboratory. In evaluating the results unified S-N-curves of welded joints in structural steel were adopted. Author

N76-18496*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRACTION CHARACTERISTICS OF A 30 BY 11.5-14.5, TYPE 8, AIRCRAFT TIRE ON DRY, WET AND FLOODED SURFACES
Thomas J. Yager and Robert C. Dreher Feb. 1976 28 p refs (NASA-TM-X-72805) Avail: NTIS HC $4.00 CSCL 01C

A limited test program was conducted to extend and

supplement the braking and cornering data on a 30 x 11.5-14.5, type VIII, aircraft tire to refine the tire/runway friction model for use in the development of an aircraft ground performance simulation. Tire traction data were obtained on dry, wet and flooded runway surfaces at ground speeds ranging from 5 to 100 knots and at yaw angles extending up to 12 deg. These friction coefficients are presented as a function of slip characteristics, namely, the maximum and skidding drag coefficients and the maximum cornering coefficients are presented as a function of both ground speed and yaw angle to extend existing data on that tire size. Tire braking and cornering capabilities were shown to be affected by vehicle ground speed, wheel yaw attitude and the extent of surface wetness. Author

N76-18497*# Standard Pressed Steel Co., Jenkintown, Pa.
DEVELOPMENT OF AN ADVANCED HIGH-TEMPERATURE FASTENER SYSTEM FOR ADVANCED AEROSPACE VEHICLE APPLICATION
F. R. Kull Oct. 1975 73 p refs
(Contract NAS1-13283)
(NASA-CR-144939) Avail: NTIS HC $4.50 CSCL 13E

The results of a program to develop a lightweight high temperature reusable fastening system for aerospace vehicle thermal protection system applications are documented. This feasibility program resulted in several fastener innovations which will meet the specific needs of the heat shield application. Three systems were designed from Hayes 188 alloy and tested by environmental exposure and residual mechanical properties. The designs include a clinch stud with a collar retainer, a weld stud with a split ring retainer, and a caged stud with a collar retainer. The results indicated that a lightweight, reusable, high temperature fastening system can be developed for aerospace vehicle application. Author

N76-18498*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND EVALUATION OF A 3 MILLION DN SERIES-HYBRID THRUST BEARING
Herbert W. Scibbe, Leo W. Winn (Mech. Tech., Inc., Latham, N. Y.), and Martin Eusepi 1976 39 p refs To be presented at the Spring Lubrication Symp., Atlanta, 24-26 May 1976; sponsored by Am. Soc. Mech. Engr.
(NASA-TM-X-71873; E-8646) Avail: NTIS HC $4.00 CSCL 13I

The bearing, consisting of a 150-mm ball bearing and a centrifugally actuated, conical, fluid-film bearing, was fatigue tested. Test conditions were representative of a mainshaft ball bearing in a gas turbine engine operating at maximum thrust load to simulate aircraft takeoff conditions. Tests were conducted up to 16000 rpm and at this speed an axial load of 15568 newtons (3500 lb) was safely supported by the hybrid bearing system. Through the series-hybrid bearing principle, the effective ball bearing speed was reduced to approximately one-half of the shaft speed. It was concluded that a speed reduction of this magnitude results in a ten-fold increase in the ball bearing fatigue life. A successful evaluation of fluid-film bearing lubricant supply failure was performed repeatedly at an operating speed of 10,000 rpm. A complete and smooth changeover to full-scale ball bearing operation was effected when the oil supply to the fluid-film bearing was cut off. Reactivation of the fluid-film oil supply system resulted in a flawless return to the original mode of hybrid operation. Author

N76-18499*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENDURANCE AND FAILURE CHARACTERISTICS OF MAIN-SHAFT JET ENGINE BEARINGS AT 3X10 TO THE 6TH POWER DN
E. N. Bamberger (General Elec. Co., Evendale, Ohio), E. V. Zaretsky, and H. Signer (Ind. Tectonics, Inc., Compton, Calif.) 1976 27 p refs To be presented at the Spring Lubrication Symp., Atlanta, 24-26 May 1976; sponsored by Am. Soc. Mech. Engr.
(NASA-TM-X-71877; E-8651) Avail: NTIS HC $4.00 CSCL 13I

Groups of thirty 120-mm bore angular contact ball bearings were endurance tested at a speed of 12,000 and 25,000 rpm and a thrust load of 66 721 N. The bearings were manufactured from a single heat of VIM-VAR AISI M-50 steel. At 1.44X1 million and 3.0x1 million DN, 84 483 and 74 800 bearing test hours were accumulated, respectively. Test results were compared with similar bearings made from CVM AISI M-50 steel run under the same conditions. Bearing lives at speeds of 3x1 million DN with the VIM-VAR AISI M-50 steel were nearly equivalent to those obtained at lower speeds. A combined processing and material life factor of 44 was found for VIM-VAR AISI M-50 steel. Continuous running after a spall has occurred at 3.0x1 million DN can result in a destructive fracture of the bearing inner race. Author

N76-18500*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN ANALYSIS OF THE DAHL FRICTION MODEL AND ITS EFFECT ON A CMG GIMBAL RATE CONTROLLER
Gerald S. Nurre Nov. 1974 26 p
(NASA-TM-X-64934) Avail: NTIS HC $4.00 CSCL 13I

The effects of friction, represented by the Dahl model, on a CMG rate control system was investigated by digital simulation. The conclusion from these simulation results is that gimbal pivot friction can be a significant effect on the gimbal rate control system. The magnitude of the problem this presents depends on the characteristics of the actual pivot. It would appear from this preliminary look that one solution is to insure that the control system natural frequency is higher by some prescribed amount than the natural frequency of the friction loop. Author

N76-18501*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EVALUATION OF DRY FILM LUBRICANTS AND SUBSTRATE MATERIALS FOR USE ON SSME GIMBAL BEARINGS
J. A. Harp Jan. 1976 27 p
(NASA-TM-X-64989) Avail: NTIS HC $4.00 CSCL 11H

Failure of the spherical bearing shaft of the Space Shuttle Main Engine (SSME) gimbal bearing assembly was encountered during Design Verification Specification testing of the full scale engine. Investigation revealed that the failure was caused by a deficiency in the lubrication system. Based upon the materials and gimbal operating conditions, a lubricant of MoS2 and graphite with a ceramic binder was the best lubricant candidate for this particular application; however, the decision to implement the change was not made without verification testing. Scaled down simulation testing was performed. Four different substrate materials and eight different dry film lubricants were subjected to tests under simulated SSME environmental and stress load conditions. The test specimens were evaluated for friction and operating life. Each test specimen was subjected to cyclic operation under load until failure. The force required to move the bearing surfaces relative to each other was monitored throughout the test, thus providing analytical data for derivation of the coefficient of friction. Results indicate that the MoS2/graphite lubricant with ceramic binder proved to be superior from the standpoint of endurance and also from the standpoint of friction reducing capabilities when applied to the titanium substrate material used on SSME. Endurance of this lubricant was approximately 16 times that of the lubricant which was being used when the SSME gimbal failed. Author

N76-18502# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
A STUDY CONCERNING LUBRICATION OF OIL SCRAPING RINGS
S. Furuhama 1976 38 p refs Transl. into ENGLISH from Nippon Kikai Gakkai-shi (Japan), v. 64, no. 515, 1961 p 1695-1705
(NRC/CNR-TT-1848) Avail: NTIS HC $4.00

An investigation of the state of the lubrication oil film between the oil scraping rings and the cylinder of the internal combustion engine was conducted as a first step toward elucidation of the oil scraping action. Author

N76-18503*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLLING-ELEMENT FATIGUE LIFE WITH TWO SYNTHETIC CYCLOALIPHATIC TRACTION FLUIDS
Stuart H. Loewenthal and Richard J. Parker Washington Mar. 1976 17 p refs

(NASA-TN-D-8124; E-8457) Avail: NTIS HC $3.50 CSCL 11H

The life potential of two synthetic cycloaliphatic hydrocarbon traction fluids in rolling element fatigue was evaluated in a five ball fatigue tester. Life comparisons with a MIL-L-23699 qualified tetraester oil showed that the traction test oils had good fatigue life performance, comparable to that of the tetraester oil. No statistically significant life differences between the traction fluids and the tetraester oil were exhibited under the accelerated fatigue test conditions. Erratic operating behavior was occasionally encountered during tests with the antiwear additive containing traction fluid for reasons thought to be related to excessive chemical activity under high contact pressure. This behavior occasionally resulted in premature test termination due to excessive surface distress and overheating. Author

N76-18504# National Aerospace Lab., Tokyo (Japan).
[A SMALL, HIGH SPEED, HIGH HEAD CENTIFUGAL LIQUID OXYGEN PUMP USING WATER AND LIQUID AS TEST FLUIDS]
Aug. 1975 45 p refs Partly in JAPANESE and ENGLISH; ENGLISH summary
(NAL-TR-415) Avail: NTIS HC $4.00

A small, high speed, high head centrifugal liquid oxygen pump was designed and experiments were conducted using water and liquid nitrogen as test fluids. A preliminary experiment with cambered inducers was conducted in a water cavitation tunnel and it was clarified that the angle of attack of inducers decisively determines the cavitation performance. Liquid nitrogen and water tests showed some difference in general performance. In particular, liquid nitrogen gave better pump efficiency but lower volumetric efficiency than water. The former may be attributed to the decrease of disk friction and hydraulic losses and the latter to the increase of leakage loss, due to the extremely lower viscosity of liquid nitrogen. With liquid nitrogen, the amount of required net positive suction head (NPSH) decrease due to the thermodynamic effects of cavitation measured and two-phase operation experienced. Author

N76-18505# Royal Aircraft Establishment, Farnborough (England).
POLYSULPHIDE SEALANTS
J. Day and D. K. Thomas Oct. 1975 30 p ref
(RAE-TR-75104; BR49415) Avail: NTIS HC $4.00

The curing characteristics of three commercial sealant formulations were studied. The material cured with manganese dioxide proved to be the most tolerant of variations in temperature and humidity while that cured with lead dioxide was the most sensitive. Heat ageing tests show that polysulfide vulcanizates are capable of retaining useful rubbery properties for long periods at 75 to 80 C and that the dichromate cured sealant is outstanding in its resistance to heat ageing at 120 C. Polysulfides in general have a poor resistance to phosphate ester based hydraulic fluid, and all the sealant formulations are liable to absorb sustantial amounts of water at elevated temperature. Author

N76-18506# Bendix Corp., Kansas City, Mo.
MEASURING PENETRATION DEPTH OF ELECTRON BEAM WELDS Final Report
J. W. Hill, M. C. Collins, C. P. Mentesana, and C. E. Watterson Jul. 1975 17 p
(Contract AT(29-1)-613)
(BDX-613-1353) Avail: NTIS HC $4.00

The feasibility of evaluating electron beam welds using techniques in the fields of holographic interferometry, micro-resistance measurements, and heat transfer was studied. The holographic study was aimed at evaluating weld defects by monitoring variations in weld strength under mechanical stress. The study proved the feasibility of this approach for evaluating welds, but it did not assign any limitations to the technique. The micro-resistance study was aimed at evaluating weld defects by measuring the electrical resistance across the weld junction as a function of distance along the circumference. Experimentation showed this method is limited by the same factors affecting other conventional nondestructive tests. Nevertheless, it was successful at distinguishing between various depths of penetration. It was also shown to be a sensitive thickness gage for thin-walled parts. The infrared study was aimed at evaluating weld defects by monitoring heat transfer through the weld under transient thermal conditions. Author (NSA)

N76-18507# Oak Ridge National Lab., Tenn.
NUCLEAR WELDING, APPLICATION FOR AN LMFBR
P. Patriarca and G. M. Goodwin 1975 38 p refs Sponsored by ERDA
(Conf-750916-1) Avail: NTIS HC $5.00

Fabrication of an LMFBR system is discussed, with emphasis on areas where joint welding innovations have been introduced. Each major component of the system, including reactor vessel, intermediate heat exchanger, steam generator, and sodium-containment piping, is treated separately. Development of special filler metals to avoid the low elevated-temperature creep ductility obtained with conventional austenitic stainless steel weldments is reported. Bore-side welding of steam generator tube-to-tubesheet joints with and without filler metal is desirable to improve inspectability and eliminate the crevice inherent with face-side weld design, thus minimizing corrosion problems. Automated welding methods for sodium-containment piping are summarized which minimize and control distortion and ensure welds of high integrity. Selection of materials for the various components is discussed for plants presently under construction, and materials predictions are made for future concepts. Author (NSA)

N76-18508# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.
WEAR MECHANICS IN HIGH SPEED SLIDING CONTACT Annual Report, Jun. 1974 - Aug. 1975
I. Komanduri and M. C. Shaw Sep. 1975 68 p refs
(Contract N00014-67-A-0314-0025; NR Proj. 097-396)
(AD-A016841; AR-1) Avail: NTIS CSCL 11/8

The concept of hard particles generation and growth due to possible crystal transformation of layered type hexagonal structured materials such as graphite, molybdenum disulfide and boron nitride, at high temperatures, concomitant high pressure and in presence of a suitable catalyst-solvent material, in high speed sliding is introduced. The mechanism of galling of polyphase materials in high speed sliding contact based on continuous depletion of second phase strengthening carbides from the matrix is presented and verified experimentally. The mechanism of sphere formation of fine chips generated in high speed sliding based on curling of chips due to a bending moment and subsequent bonding of many such curved chips into a sphere due to the curved platelets being highly polarized, is presented and qualitatively verified experimentally. GRA

N76-18509# Dow Corning Corp., Midland, Mich.
DYNAMIC AND STATIC EVALUATION OF EXPERIMENTAL INTEGRAL FUEL TANK SEALANT MATERIALS Final Report, 1 May 1972 - 31 Jul. 1974
Dec. 1974 81 p refs
(Contract F33615-72-C-1594; AF Proj. 7340)
(AD-A015802; AFML-TR-74-245) Avail: NTIS CSCL 11/1

This final technical report describes the investigation and evaluation of experimental integral fuel tank sealants under laboratory conditions simulating aircraft integral fuel tanks. Materials investigated were Dow Corning 77-028, 77-085, 3M Polyester, TRW Polyimide, Polysulfide and AFML Viton. These materials were evaluated dynamically in a fillet sealed configuration. This report also describes in detail the functions, operations and problems encountered with the dynamic test apparatus that has been designed and fabricated for the purpose of evaluating experimental aircraft integral fuel tank sealants. A portion of the effort was required to diagnose deficiencies and mechanical failures of the testing equipment which resulted in the lack of conclusive data in the report. GRA

N76-18510# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering and Astronautical Sciences.
FRICTIONAL WEAR MECHANISMS Annual Report, 1974 - 1975
Aug. 1975 103 p refs
(Contract N00014-67-A-0356-0022; NR Proj. 097-398)
(AD-A015720; Rept-5341-413) Avail: NTIS CSCL 11/1

The report summarizes three complementary studies of seal

contact, where frictional heating can lead to distortion of the contacting surfaces. The first shows that contact shear stress has negligible effect in determining contact pressure. A critical-wear-rate measure is introduced. When actual wear rate exceeds the critical value, stability of contact is assured and surface distortions tend to smooth out. The second assumes the surfaces have distorted to the point where they contact only at patches, and shows when such patches can exist, again demonstrating the role of critical wear rate. The third treats the case where a liquid film separates the surfaces showing that viscous heating can lead to surface-distortion instability. Introductory material is included, showing how the problem fits into the field of tribology, reviewing the development of the project and setting the problem in historical perspective. GRA

N76-18511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TAMING A PHENOMENON
A. Silin 2 May 1975 11 p Transl. into ENGLISH from Krasnaya Zvezda (USSR), 8 Dec. 1974 p 4
(AD-A016141; FTD-ID(RS)I-1281-75) Avail: NTIS CSCL 20/11

This translation presents a discussion of friction and methods for reducing friction. The relation between wear and efficiency of machinery is described. GRA

N76-18512# Norton Co., Worcester, Mass. Industrial Ceramics Div.
SILICON NITRIDE IN ROLLING CONTACT BEARINGS Final Report, 15 Mar. 1974 - 15 Jul. 1975
H. Robert Baumgartner and Paul E. Cowley Aug. 1975 112 p refs
(Contract N00019-74-C-0157)
(AD-A015990) Avail: NTIS CSCL 13/9

The program (1) investigated silicon nitride material characteristics in relation to bearing performance and (2) endurance tested bearings containing silicon nitride components. Six hot-pressed silicon nitride compositional variations were prepared, characterized and evaluated in rolling contact fatigue (RCF). All ceramic fatigue lives equaled or exceeded the fatigue life of M-50 steel at the 325 pound load. A stress corrosion mechanism is used to explain the time dependent ceramic fatigue behavior and life differences are attributed to differences in slow crack growth rates. Ten precision, 60 mm bore, roller bearings, containing silicon nitride rollers, steel races and retainer, were designed, fabricated and endurance tested at a radial load of 5050 pounds and shaft speed of AFBMA calculated L(10) life of 21.6 hours for a similar all steel bearing. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-18513 Cincinnati Univ., Ohio.
THE ECONOMICS OF QUALITY CONTROL: A NEW APPROACH Ph.D. Thesis
Ehud Menipaz 1975 205 p
Avail: Univ. Microfilms Order No. 76-4671

A report is made on the development of an approach to the economics of quality control; the approach is based on an analogy between a quality control system and a system of maintenance of equipment that is subject to random failures. Data provide: (1) an operational framework for finding the best cost effective quality control policy, while taking into account variable costs and discount factor, and (2) the feasibility of developing models that are practical and comparatively easy to implement from the managerial point of view. The policies that are developed here allow the time between successive sampling actions to vary, allow the costs to vary in one way or another within the optimization interval and also take into account a discount factor. While increasing the flexibility of economically based quality control policies, an effort is made to keep the policies as simple to implement as possible. This pragmatic approach was further enhanced by presenting procedures for solution that can be easily programmed for a computer.
Dissert. Abstr.

N76-18514# Vought Helicopter Corp., Grand Prairie, Tex.
FAN-IN-FIN FAILURE RATE AND SCRAP ANALYSIS Final Report
J. K. Davidson Mar. 1975 244 p refs
(Contract DAAJ02-73-C-0007; DA Proj. 1F1-62205-A-119)
(AD-A015632) Avail: NTIS CSCL 01/3

This report presents an analysis of field-collected reliability, maintainability, and cost data reported for selected fleets of Alouette II, Alouette III, and SA 341 helicopter antitorque systems that accumulated 10,000 to 15,000 flight hours per aircraft model. The purpose of this program was to study the reliability, maintainability, safety and cost characteristics of an antitorque systems of the fan-in-fin type compared with an equivalent antitorque system of the conventional tail rotor type, in order to furnish bench mark data for the design of furture helicopter antitorque systems. The Aerospatiale built SA 341 Gazelle was monitored in commercial operations for the fan-in-fin data. Both the Alouette II and Alouette III (also made by Aerospatiale) were monitored in commercial operations to obtain the conventional tail rotor data. GRA

N76-18515# Kentucky Univ., Lexington. Dept. of Statistics.
A CLASS OF DISTRIBUTIONS USEFUL IN LIFE TESTING AND RELIABILITY
Z. Govindarajulu Aug. 1975 15 p refs
(Contract N00014-75-C-1003)
(AD-A016297; TR-90; TR-12-ONR) Avail: NTIS CSCL 13/1

A new class of distributions having a finite range that are useful in life testing and reliability is proposed. Methods of estimating the unknown parameters are studied. Explicit expressions for lower moments of order statistics in random samples of any size are derived. A uniformly most powerful test is derived for the 'shape' parameter and it is illustrated by the data on times to failure of refrigerator motors. GRA

N76-18516# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL DESIGN OF RELIABLE SYSTEMS
David Allen Butler 5 May 1975 125 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A016598; TR-169) Avail: NTIS CSCL 14/4

Any decision about how to design for a given level of system reliability carries with it cost implications and an obvious consideration in the design of a system is how to optimally allocate the available resources in order to achieve the reliability requirements. This is the type of problem considered in this paper. Specifically this paper will focus upon the problem of how to optimally choose component reliabilities in order to minimize the cost of designing and manufacturing the components subject to a lower bound on the system reliability and upper and lower bounds on the component reliabilities. GRA

N76-18517# Stanford Univ., Calif. Dept. of Statistics.
IMPORTANCE MEASURES FOR HIGHLY RELIABLE SYSTEMS
David A. Butler 27 May 1975 43 p refs
(Contract N00014-75-C-0561; NR Proj. 042-002)
(AD-A016599; TR-170) Avail: NTIS CSCL 14/4

It is often desirable to maximize the reliability of a coherent system subject to resource constraints. However, for complex systems a formal optimization may not be feasible. For such systems, an approach which is often taken is to focus the resources on some small subset of components which are hopefully most critical to the system reliability. Such considerations lead to the notion of measures of component importance (re system reliability). These measures may take the form of relative rankings among components or may be absolute measures. Both mathematical and engineering definitions of component importance exist. The mathematical definitions typically have the feature of having desirable mathematical properties. The engineering definitions typically have the advantage of being easily calculated and of requiring a minimum of information. In this paper some mathematical and some engineering measures of component importance are compared. Some results are established which give some guidelines as to when one measure is preferable to

the others. These results also make more explicit the underlying assumptions of the various measures. GRA

N76-18518# Pennsylvania State Univ., University Park. Applied Research Lab.
A STRENGTH-STRESS INTERFERENCE MODEL FOR TIME-VARYING PROBABILITY OF FAILURE AND ITS APPLICATION TO AN ELECTROMECHANICAL SYSTEM Ph.D. Thesis
Paul H. Kurtz 16 Apr. 1975 218 p refs
(Contract N00017-73-C-1418)
(AD-A016299; TM-75-122) Avail: NTIS CSCL 14/4

In electromechanical systems, failure can be represented as the application of a stress to some component which exceeds the corresponding strength of that component. In general, both the stress and strength will be random variables. Aging, wear and overstress conditions can then be considered as phenomena which cause time variation of either the stress or the strength distribution for a particular failure mechanism. The research presented in this thesis develops probabilistic models for the time variation of stress and strength distributions due to these effects, thus permitting prediction of probability of failure as a function of time without a priori knowledge of system failure statistics. GRA

N76-18519# Naval Surface Weapons Center, Dahlgren, Va.
THE ULTRASONIC INSPECTION OF CAST EXPLOSIVE BILLETS Final Report
Gerald V. Blessing and Jeffery M. Warren Sep. 1975 71 p refs
(AD-A016025; NSWC/DL-TR-3332) Avail: NTIS CSCL 19/1

The development of an ultrasonic inspection capability to detect air voids in PBXN-106 cast explosive billets is described. Beginning with feasibility tests, the evolution of a suitable technique through research and development has culminated in the design and fabrication of an assembly-line prototype system. Principal attention is given to the technical development portion of the program. The choice of optimum ultrasonic transducers for both transmission and reflection, and the associated electronics hardware is described. A critical analysis of focused transducers, transducer bandwidth, and couplant materials is presented, in addition to the ultrasonic frequency dependence of the energy attenuation in the explosive. Several methods of hard-copy production for permanent flaw recording are described. Automatic gain control of the output signal is discussed for applications to a completely automated recording system. Finally, on-line test results are given to compare the flaw detection capability of the ultrasonic system to that of X-ray. GRA

N76-18520# Georgetown Univ., Washington, D.C. Inst. for Management Science and Engineering.
SOME STOCHASTIC CHARACTERIZATIONS OF MULTIVARIATE SURVIVAL
William B. Buchanan and Nozer D. Singpurwalla 18 Jul. 1975 36 p refs
(Contracts N00014-75-C-0729; F33615-74-C-4040; NR Proj. 347-020)
(AD-A015668; Serial-T-319) Avail: NTIS CSCL 14/4

This paper deals with multivariate analogues to the five well developed univariate characterizations of wear. The objective is to explore variations of these five analogues, study their properties and obtain implications between them. A rationale is provided as to how some of the multivariate variations arise by considering a multivariate shock model. This shock model is based on the multivariate exponential distribution of Marshall and Olkin and the theory of univariate shock models and wear processes of Esary, Marshall and Proschan. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-18521 Texas A&M Univ., College Station.
ALLOWABLE BENDING MOMENT ON A SECTION OF PIPE LOADED BY INTERNAL PRESSURE AND AXIAL FORCE Ph.D. Thesis
Stanford Alfred Smith, Jr. 1975 155 p
Avail: Univ. Microfilms Order No. 76-3675

Equations specifying the bending moments which cause yielding of pipe sections loaded by internal pressure and axial force were developed. These expressions are based upon the von Mises yield criterion and include the experimental results from tests of thirty-two pipe specimens. Similar expressions giving the bending moments which cause the pipe sections to collapse under combined loading are also formulated. These relationships were developed for an idealized rigid-plastic material and modifications based upon the experimental data are included. The alterations required for agreement between the experimental and theoretical values of bending moment are given in terms of the ratio of the outside diameter of the pipe to the thickness of the pipe wall. The resulting expressions are given in a practical, usable form which facilitates the computation of bending moments that would produce yielding or collapse for a wide range of pipe sizes. Experimental data relating the ovalization of the pipe cross section to the applied loads are included. Dissert. Abstr.

N76-18522 Colorado State Univ., Fort Collins.
QUARTER-ELLIPTICAL CRACKS EMANATING FROM HOLES IN PLATES Ph.D. Thesis
Gary Parke Ganong 1975 155 p
Avail: Univ. Microfilms Order No. 76-4308

A linear elastic solution technique is presented for the determination of stress intensity factors along the periphery of part-elliptical cracks in irregular bodies. An extension of the Schwarz-Neumann alternating method, a superposition and iteration technique, was used. This extension incorporates the finite element method and the analytic solution for the stresses in an infinite solid with a flat elliptical crack. Stress intensity factors are presented as a function of position around the periphery of the crack for quarter-elliptical cracks emanating from holes in plates, for a variety of crack geometries. The results of this study are compared to experimental data and to estimates by other authors. Dissert. Abstr.

N76-18523 Iowa Univ., Iowa City.
OPTIMAL DESIGN OF ELASTIC STRUCTURES UNDER DYNAMIC LOADS Ph.D. Thesis
Tseng-Tien Feng 1975 145 p
Avail: Univ. Microfilms Order No. 76-2117

A technique for elastic structural optimization under dynamic loads was developed. The method is based on the steepest descent optimization techniques of Bryson and the finite element techniques of dynamic analysis of structures. A general objective functional dependent on state variables, frequencies, and design variables is considered. Constraints imposed are limits on displacements, stresses, frequencies, and design variables. Dynamic response constraints are imposed for all time and are transformed into equivalent functional constraints. In developing the algorithm, all constraints and equations of the problem are linearized and changes in the state variable appearing in the linearized forms are eliminated through the use of adjoint relationships. Dimensions of the analysis problem, eigenvalue problem, and system sensitivity problem are reduced by using a transformation matrix which contains eigenmodes of the constrained structure. The reduced optimal design problem is solved by employing Kuhn-Tucker necessary conditions of nonlinear programming. This leads to an algorithm for successively improving the design. Dissert. Abstr.

N76-18524 Ohio State Univ., Columbus.
SHEAR-STRESS THEORY OF SPHERICAL SHELLS Ph.D. Thesis
Robert Oscar Johnson 1975 150 p
Avail: Univ. Microfilms Order No. 76-3462

An application of a method of solving the shear-stress theory of spherical shells is presented. A shell is considered as a two-dimensional surface embedded in a three-dimensional Euclidean space. Instead of the conventional conditions of equilibrium taken from statics of a rigid body, a more general

principle of virtual work is used. This principle is actually a definition of equilibrium and it applies to any mechanical system. Moreover it allows classification of shells according to the constraints imposed on the virtual displacements. The components of deformations are uniquely determined by the constraints or the form of the virtual work which defines the particular shell. The formulae are definite and their derivation does not require any ad-hoc hypothesis or geometrical approximation. The exact shear-stress theory is worked-out for a spherical cap. Equations of equilibrium expressed in terms of displacements are obtained for the cap as well as equations of equilibrium on the boundary of the cap. Dissert. Abstr.

N76-18525*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF STRAINRANGE PARTITIONING TO PREDICT HIGH TEMPERATURE LOW-CYCLE FATIGUE LIFE
Marvin H. Hirschberg and Gary R. Halford Washington Jan. 1976 30 p refs
(NASA-TN-D-8072; E-8294) Avail: NTIS HC $4.00 CSCL 20K

The fundamental concepts of the strainrange partitioning approach to high temperature, low low-cycle fatigue are reviewed. Procedures are presented by which the partitioned strainrange versus life relationships for any material can be generated. Laboratory tests are suggested for further verifying the ability of the method of strainrange partitioning to predict life. Author

N76-18526*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMMAND: A FORTRAN PROGRAM FOR SIMPLIFIED COMPOSITE ANALYSIS AND DESIGN
Garret N. VanDerPlaats Feb. 1976 52 p refs
(NASA-TM-X-73104; A-6435) Avail: NTIS HC $4.50 CSCL 20K

A FORTRAN program is presented for preliminary analysis and design of multilayered composite panels subjected to inplane loads. All plys are of the same material. The composite is assumed symmetric about the midplane, but need not be balanced. Failure criterion includes limit ply strains and lower bounds on composite inplane stiffnesses. Multiple load conditions are considered. The required input data is defined and examples are provided to aid the use in making the program operational. Average panel design times are two seconds on an IBM 360/67 computer. Results are compared with published literature. A complete FORTRAN listing of program COMAND is provided. In addition, the optimization program CONMIN is required for design. Author

N76-18527# Aeronautical Research Labs., Melbourne (Australia).
CALCULATION OF JACK LOADS FOR A WING FATIGUE TEST USING LINEAR PROGRAMMING
R. J. Callinan Aug. 1975 45 p refs
(ARL/Struc-Note-416) Avail: NTIS HC $4.00

In a fully representative wing fatigue test, it is necessary to calculate sets of jack loads simulating aerodynamic, inertia, and store loads for large numbers of flight configurations. The use of linear programming is suggested for giving an 'optimum' set of jack loads under constraints set by the geometry of the whiffle tree and safe loads for the jacks and pads. This optimum is defined by the requirement that, in certain fatigue critical areas, the difference between the stresses due to the jack loads and the actual flight stresses should be a minimum. As an example, the application of the method to the Mirage wing test recently carried out is described. Author

N76-18528*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL AND EXPERIMENTAL STUDY OF STRUCTURALLY EFFICIENT COMPOSITE HAT-STIFFENED PANELS LOADED IN AXIAL COMPRESSION
Jerry G. Williams and Martin M. Mikulus, Jr. 7 Jan. 1976 23 p refs Presented at ASME/AIAA/SAE 16th Structures, Structural Dynamics, and Materials Conf., May 1975
(NASA-TM-X-72813) Avail: NTIS HC $3.50 CSCL 20K

Structural efficiency studies were made to determine the weight saving potential of graphite/epoxy composite structures for compression panel applications. Minimum weight hat-stiffened and open corrugation configurations were synthesized using a nonlinear mathematical programming technique. Selected configurations were built and tested to study local and Euler buckling characteristics. Test results for 23 panels critical in local buckling and six panels critical in Euler buckling are compared with analytical results obtained using the BUCLASP-2 branched plate buckling program. A weight efficiency comparison is made between composite and aluminum compression panels using metal test data generated by the NACA. Theoretical studies indicate that potential weight savings of up to 50% are possible for composite hat-stiffened panels when compared with similar aluminum designs. Weight savings of 32% to 42% were experimentally achieved. Experience suggests that most of the theoretical weight saving potential is available if design deficiencies are eliminated and strict fabrication control is exercised. Author

N76-18529*# Boeing Aerospace Co., Seattle, Wash.
DESIGN, FABRICATION, AND TEST OF A GRAPHITE/EPOXY METERING TRUSS Final Report, Feb. 1974 - Dec. 1975
S. Oken and D. E. Skoumal Dec. 1975 167 p
(Contract NAS8-29825)
(NASA-CR-144177; D180-19335-1) Avail: NTIS HC $6.75 CSCL 20K

A graphite/epoxy metering truss as applied to the large space telescope was investigated. A full-scale truss was designed, fabricated and tested. Tests included static limit loadings, a modal survey and thermal-vacuum distortion evaluation. The most critical requirement was the demonstration of the dimensional stability provided by the graphite/epoxy truss concept. Crucial to the attainment of this objective was the ability to make very sophisticated thermal growth measurements which was provided by a seven beam laser interferometer. The design of the basic truss elements were tuned to provide the high degree of dimensional stability and stiffness required by the truss. The struts and spider assembly were fabricated with Fiberite's AS/934 and HMS/934 broadgoods. The rings utilized T300 graphite fabricate with the same materials. The predicted performance of the truss was developed using the NASTRAN program. These results showed conformance with the critical stiffness and thermal distortion requirements and correlated well with the test results. Author

N76-18530*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RESIZING PROCEDURE FOR OPTIMUM DESIGN OF STRUCTURES UNDER COMBINED MECHANICAL AND THERMAL LOADING
Howard M. Adelman and R. Narayanaswami Jan. 1976 25 p refs
(NASA-TM-X-72816) Avail: NTIS HC $3.50 CSCL 13M

An algorithm is reported for resizing structures subjected to combined thermal and mechanical loading. The algorithm is applicable to uniaxial stress elements (rods) and membrane biaxial stress members. Thermal Fully Stressed Design (TFSD) is based on the basic difference between mechanical and thermal stresses in their response to resizing. The TFSD technique is found to converge in fewer iterations than ordinary fully stressed design for problems where thermal stresses are comparable to the mechanical stresses. The improved convergence is demonstrated by example with a study of a simplified wing structure, built-up with rods and membranes and subjected to a combination of mechanical loads and a three dimensional temperature distribution. Author

N76-18531*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NASA RESEARCH ON STRUCTURES AND MATERIALS FOR SUPERSONIC CRUISE AIRCRAFT
Paul A. Cooper and Richard R. Heldenfels Jan. 1976 45 p refs
(NASA-TM-X-72790) Avail: NTIS HC $4.00 CSCL 01C

The technology and data base necessary for sound technical decisions regarding long haul supersonic cruise aircraft transportation systems are considered. The objectives and status of the research elements in the structures and materials program phase of the program are reviewed. Emphasis is placed on reductions in structural mass by research on advanced structural concepts, light-weight materials, improved loads, aeroelastic predictive

techniques, and by development of efficient structural design procedures. Author

N76-18532*# Boeing Co., Seattle, Wash.
PRELIMINARY WEIGHT AND COSTS OF SANDWICH PANELS TO DISTRIBUTE CONCENTRATED LOADS
G. Belleman and J. E. McCarty 15 Feb. 1976 103 p
(Contract NAS1-13338)
(NASA-CR-144915; D6-42680) Avail: NTIS HC $5.50 CSCL 13M

Minimum mass honeycomb sandwich panels were sized for transmitting a concentrated load to a uniform reaction through various distances. The form skin gages were fully stressed with a finite element computer code. The panel general stability was evaluated with a buckling computer code labeled STAGS-B. Two skin materials were considered; aluminum and graphite-epoxy. The core was constant thickness aluminum honeycomb. Various panel sizes and load levels were considered. The computer generated data were generalized to allow preliminary least mass panel designs for a wide range of panel sizes and load intensities. An assessment of panel fabrication cost was also conducted. Various comparisons between panel mass, panel size, panel loading, and panel cost are presented in both tabular and graphical form. Author

N76-18533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ON THE RELATION OF J SUB I TO WORK DONE PER UNIT UNCRACKED AREA: TOTAL, OR COMPONENT 'DUE TO CRACK'
John E. Srawley 1976 9 p refs Proposed for presentation at conf. of Am. Soc. for Testing and Mater., Committee E-24, Orlando, Fla., 22-26 Mar. 1976
(NASA-TM-X-71882; E-8655) Avail: NTIS HC $3.50

The direct evaluation of Rice's JI as a function of displacement, from the load-displacement record of a test of a single precracked specimen, was discussed. Special attention was given to the general form of the underlying relation. Author

N76-18534# National Research Council of Canada, Ottawa (Ontario). National Aeronautical Establishment.
A METHOD AND COMPUTER PROGRAMME FOR DERIVING A LOADS SPECTRUM FROM ACCELEROMETER DATA
R. Hangartner 19 Jun. 1975 40 p refs
(LTR-ST-776) Avail: NTIS HC $4.00

Aircraft accelerations in the vertical plane form the basis of fatigue life calculations. These accelerations are often acquired by some form of accelerometer or VgH recorder. The results are usually plotted in the form of a spectrum of cumulative rates of exceedances versus normal accelerations. A simple method and computer program are described for converting a continuous spectrum into steps containing an integral number of cycles. This approach is necessary when the loads spectrum is to be used for conducting fatigue experiments. Examples of flight loads spectra and computer output are presented for fighter, trainer, and transport aircraft. The number of intervals into which a spectrum is divided and the upper and lower limits of the spectrum are also briefly discussed. Author

N76-18535# Hudson (W. Ronald), Austin, Tex.
STATE-OF-THE-ART IN PREDICTING PAVEMENT RELIABILITY FROM INPUT VARIABILITY Final Report, Sep. 1974 - Jan. 1975
W. Ronald Hudson Aug. 1975 72 p refs Sponsored by Army Engr. Waterways Expt. Station, Vicksburg, Miss.
(Contract DOT-FA73WAI-377)
(AD-A018904/3; FAA-RD-75-207) Avail: NTIS HC $5.00 CSCL 13/2

The concept of reliability in pavement design was discussed. Data cover the improvement of pavement design and the fact that pavement management systems methodologies provide an ideal framework for considering reliability. Consideration is given to three techniques for reducing variability in design: (1) improved quality control, (2) use of design confidence level, and (3) the concept of reliability level. The philosophy of determining and corroborating reliability levels is discussed and recommendations for work to advance the state-of-the-art are presented. Author

N76-18536*# McDonnell-Douglas Corp., St. Louis, Mo.
A FUSELAGE/TANK STRUCTURE STUDY FOR ACTIVELY COOLED HYPERSONIC CRUISE VEHICLES, SUMMARY Final Report
C. J. Pirrello, A. H. Baker, and J. E. Stone Washington NASA Feb. 1976 78 p refs
(Contract NAS1-12995)
(NASA-CR-2651) Avail: NTIS HC $5.00 CSCL 01C

A detailed analytical study was made to investigate the effects of fuselage cross section (circular and elliptical) and the structural arrangement (integral and nonintegral tanks) on aircraft performance. The vehicle was a 200 passenger, liquid hydrogen fueled Mach 6 transport designed to meet a range goal of 9.26 Mn (5000 NM). A variety of trade studies were conducted in the area of configuration arrangement, structural design, and active cooling design in order to maximize the performance of each of three point design aircraft: (1) circular wing-body with nonintegral tanks, (2) circular wing-body with integral tanks and (3) elliptical blended wing-body with integral tanks. Aircraft range and weight were used as the basis for comparison. The resulting design and performance characteristics show that the blended body integral tank aircraft weights the least and has the greatest range capability, however, producibility and maintainability factors favor nonintegral tank concepts. Author

N76-18537*# California Univ., Los Angeles.
APPROXIMATION CONCEPTS FOR EFFICIENT STRUCTURAL SYNTHESIS
Lucien A. Schmit, Jr. and Hirokazu Miura Washington NASA Mar. 1976 311 p refs
(Grant NGR-05-007-337)
(NASA-CR-2552) Avail: NTIS HC $9.75 CSCL 13M

It is shown that efficient structural synthesis capabilities can be created by using approximation concepts to mesh finite element structural analysis methods with nonlinear mathematical programming techniques. The history of the application of mathematical programming techniques to structural design optimization problems is reviewed. Several rather general approximation concepts are described along with the technical foundations of the ACCESS 1 computer program, which implements several approximation concepts. A substantial collection of structural design problems involving truss and idealized wing structures is presented. It is concluded that since the basic ideas employed in creating the ACCESS 1 program are rather general, its successful development supports the contention that the introduction of approximation concepts will lead to the emergence of a new generation of practical and efficient, large scale, structural synthesis capabilities in which finite element analysis methods and mathematical programming algorithms will play a central role. Author

N76-18538# California Univ., Livermore. Lawrence Livermore Lab.
PROPOSED PRESSURE VESSEL CONCEPT AND DESIGN FOR TRITIUM GAS FOR OPERATION TO PRESSURES OF 68.95 MPa (680.5 atm) AND TEMPERATURES TO 1000 C
J. F. Lakner 9 Jul. 1975 43 p refs
(Contract W-7405-eng-48)
(UCID-16833) Avail: NTIS HC $5.25

A proposed design for a pressure vessel to contain thermally hot tritium is described. It is a lined cylinder designed for operation to pressures of 68.95 MPa (680.5 atm) and to temperatures of 1000 C. Since these conditions do not allow for external heating, due to reduced strength of alloys and high gas-permeation rate at high pressures and temperatures, it is necessary to use internal heaters. In order to keep the amount of T2 to a minimum for any particular experiment, it was decided to design a system where the T2 would be contained in a small pressure vessel situated within a larger pressure vessel, with the internal pressure balanced externally with a nonradioactive gas. An additional advantage of such a system is that the specimen under T2 does not see the heater environment and so contamination of the specimen is reduced. Author (NSA)

N76-18539# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
SIMPLIFIED INELASTIC (PLASTIC AND CREEP) ANALYSIS OF PIPE ELBOWS SUBJECTED TO INPLANE AND OUT-OF-

PLANE BENDING
R. M. Mello and J. D. Scheller Dec. 1974 38 p refs Presented at Second ASME Natl. Congr. on Pressure Vessels and Piping, San Francisco, 24 Jun. 1975
(Contract AT(11-1)-3045)
(Conf-750617-20) Avail: NTIS HC $5.00

The inelastic analysis of elbows typical of use in Liquid Metal Fast Reactor piping systems is described. Detailed information on stresses, plastic and creep strains, and deformations throughout the elbow bodies resulting from elastic/plastic, elastic/plastic/creep, and elastic/plastic-creep/relaxation material behavior was obtained for the cases of applied inplane and out-of-plane moment loading on the elbows. Some conclusions are made concerning the nature of the resulting stresses in the elbows. The simplified pipe-bend element in the MARC nonlinear finite element program is used as the analytical tool. This element permits nonlinear analysis of piping elbows and pipeline systems at realistic cost. Author (NSA)

N76-18540# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
UNIFIED APPROACH TO ELASTIC-PLASTIC FRACTURE MECHANICS
B. K. Neale and C. H. A. Townley May 1975 48 p refs
(RD/B/N-3358) Avail: NTIS HC $4.00

To assess the integrity of a cracked structure, using materials data obtained from simple laboratory tests, it is essential to define materials properties which are independent of the shape and the size of the specimen and of the loading system applied to it. In those situations where either the specimen or the structure fails after significant yielding has taken place, there is considerable speculation about the materials parameters which are relevant. By extending the Griffith equation for the stability of a perfectly elastic cracked body, a fracture criterion which is applicable in the post yield regime is derived. Comparisons are made with procedures based on the J-contour integral, equivalent energy, and crack opening displacements and with the post yield fracture mechanics of Heald, Spink and Worthington, and Dowling and Townley. For certain materials, it is shown that the factor controlling crack initiation is the fracture toughness K1c, irrespective of the amount of prior plastic damage, and hence independent of the shape and size of the specimen tested. Load carrying capacity in the post yield regime cannot, however, be derived directly from a knowledge of fracture toughness; the ultimate tensile strength of the material is also relevant.
Author (NSA)

N76-18541# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
UTILIZATION OF CARBON FIBER REINFORCED PLASTICS IN SATELLITE STRUCTURES Final Report [ETUDE SUR L'UTILISATION DE PLASTIQUES RENFORCES PAR FILAMENTS DE CARBONE DANS LES STRUCTURES DE SATELLITES]
6 Feb. 1975 298 p In FRENCH
(Contract ESTEC-1736/72)
(Rept-3586-CA/80; ESA-CR(P)-628) Avail: NTIS HC $9.25

Tests were carried out to attest the dimensional stability and vibration resistance of curved sandwich antenna reflectors using carbon fiber reinforced plastic soles. Adhesion tests, thermal cycling tests, dimensional stability tests, and thermal dilatation tests were included. The feasibility is confirmed of a curved sandwich reflector identical to the Symphonie satellite reflector but using carbon fiber reinforced plastic soles instead of silicon soles. Future work including optimization of fabrication methods and tests as well as correlation of dimensional calculation methods to mechanical test results is suggested. For individual titles, see N76-18542 through N76-18548.

N76-18542 Societe Nationale Industrielle Aerospatiale, Cannes (France).
INVESTIGATION ON ADHESION QUALITIES OBTAINED WITH MINIMAL JOINT MASS [RAPPORT TECHNIQUE SUR LA RECHERCHE DES QUALITES D'ADHERENCE OBTENUES AVEC UNE MASSE MINIMALE DE JOINT]
Gatineau, Legeret, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 31 p In FRENCH (For availability see N76-18541 09-39)
(Rept-3039-CA/80)

Adhesion tests were carried out for carbon fiber reinforced plastics stuck to a piece of nida aluminum with a minimal joint mass. The results were compared to those obtained using two other adhesives. ESA

N76-18543 Societe Nationale Industrielle Aerospatiale, Cannes (France).
INVESTIGATION OF MECHANICAL PROPERTIES [RAPPORT TECHNIQUE SUR L'ETUDE DES PROPRIETES MECANIQUES]
Gatineau, Legeret, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 34 p In FRENCH (For availability see N76-18541 09-39)
(Rept-3040-CA/80)

Bending tests were carried out for carbon fiber reinforced plastics stuck to a piece of nida aluminum at three different temperatures -20, +20, and +50 C to investigate the mechanical properties of sandwich structures at different temperatures. ESA

N76-18544 Societe Nationale Industrielle Aerospatiale, Cannes (France).
TESTING OF DETERIORATIONS DUE TO THERMAL CYCLING [RAPPORT TECHNIQUE SUR LES ESSAIS DE DETERIORATIONS DUES AUX CYCLAGES THERMIQUES]
Louis, Cecconi, M. Girard, A. Tardivo, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 29 p In FRENCH (For availability see N76-18541 09-39)
(Rept-2860-CA/80)

Thermal cycling tests were carried out on carbon fiber reinforced plastics to investigate the influence of thermal cycling on carbon fiber composite structure degradation during a satellite flight. The mechanical properties of carbon fiber reinforced plastics samples were measured after thermal tests and compared to those of samples not subjected to thermal tests. ESA

N76-18545 Societe Nationale Industrielle Aerospatiale, Cannes (France).
THERMAL DILATATION TESTS ON SANDWICH CARBON FIBER SOLE [RAPPORT TECHNIQUE SUR LES ESSAIS DE DILATATION THERMIQUE D'UNE EPROUVETTE SANDWICH A SEMELLES EN FIBRE DE CARBONE]
M. Girard, A. Tardivo, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 21 p In FRENCH (For availability see N76-18541 09-39)
(Rept-2936-CA/80)

Thermal tests were carried out on sandwich carbon fiber reinforced plastic structures identical to the Symphonie satellite reflector sandwich structure in order to investigate the reflector dilatation coefficient. It is concluded that sandwich carbon fiber reinforced plastic structures are suitable for antenna and optical component support applications. ESA

N76-18546 Societe Nationale Industrielle Aerospatiale, Cannes (France).
DIMENSIONAL STABILITY TESTS ON CURVED SANDWICH REFLECTOR [RAPPORT TECHNIQUE SUR LES ESSAIS DE STABILITE DIMENSIONNELLE D'UN REFLECTEUR SANDWICH GALBE] **c27**
I. Martinez, Carton, Fagnoni, M. Girard, A. Tardivo, Thorn, Mailfert, Gachod, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 71 p In FRENCH (For availability see N76-18541 09-39)
(Rept-3038-CA/80)

Thermal (cycling, gradient) tests were carried out on a curved sandwich carbon fiber reflector identical to the Symphonie satellite reflector in order to investigate the thermal deformations of carbon fiber reinforced plastic structures of an antenna reflector during satellite flight. The test results were compared to those obtained using the Symphonie silicon fiber reflector. It is concluded that carbon fiber reinforced plastic structures are suitable for dimensional stability applications such as reflectors, optical supports, and sensors. ESA

N76-18547 Societe Nationale Industrielle Aerospatiale, Cannes (France).
ESTIMATION OF CURVED SANDWICH REFLECTOR DEFORMATIONS [RAPPORT D'ETUDES SUR

L'ESTIMATION DES DEFORMATIONS D'UN REFLECTEUR SANDWICH GALBE]

I. Martinez and J. Lizon-Tati *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 27 p In FRENCH (For availability see N76-18541 09-39)
(Rept-3592-CA/80)

In order to predict the radio transmission performance of satellite antenna reflectors, the temperature levels on a carbon fiber reinforced plastic reflector were determined. A temperature distribution chart in the case of Symphonie mission type was determined along with thermal deformations of a carbon fiber reinforced plastic reflector operating in Symphonie conditions. ESA

N76-18548 Societe Nationale Industrielle Aerospatiale, Cannes (France).

VIBRATION TESTS ON A REFLECTOR [RAPPORT TECHNIQUE SUR LES ESSAIS DE VIBRATIONS D'UN REFLECTEUR]

J. Agliany, M. Pourrat, and G. Urbain *In its* Util. of Carbon Fiber Reinforced Plastics in Satellite Struct. 6 Feb. 1975 70 p In FRENCH (For availability see N76-18541 09-39)
(Rept-3486-CA/80) Copyright.

Vibration tests were carried out on Symphonie type carbon fiber reinforced plastic reflector mounted on titanium support in order to measure the resonant frequencies of this reflector and to compare the results to those obtained using silicon Symphonie reflector mounted on the same support. ESA

N76-18549# West Virginia Dept. of Highways, Charleston.

APPLICATION OF NONDESTRUCTIVE TESTING TECHNIQUES FOR EVALUATION OF THE ENGINEERING PROPERTIES OF PORTLAND CEMENT CONCRETE, VOLUME 1 Final Report

Roger K. Seals and David A. Anderson Jan. 1975 106 p Prepared in cooperation with West Virginia Univ., Morgantown 2 Vol.
(PB-245648/1; WVADH-37-2-Vol-1) Avail: NTIS HC $5.50 CSCL 13C

The principal goals of the Phase 1 and Phase 2 studies were, respectively: (1) to establish the validity of predicting strength from nondestructive measurements and to select an optimum combination of sample configuration - test method - sample preparation technique for use in Phase 2 and 3 and (2) to study the effects of aggregate type, water:cement ratio, and cement factor on the prediction of long term strength from early-time pulse velocity measurements. GRA

N76-18550# West Virginia Dept. of Highways, Charleston.

APPLICATION OF NONDESTRUCTIVE TESTING TECHNIQUES FOR EVALUATION OF THE ENGINEERING PROPERTIES OF PORTLAND CEMENT CONCRETE, VOLUME 2: APPENDICES Final Report

Roger K. Seals and David A. Anderson Jan. 1975 140 p refs Prepared in cooperation with West Virginia Univ., Morgantown 2 Vol.
(PB-245649/9; WVADH-37-2-Vol-2) Avail: NTIS HC $6.00 CSCL 13C

The principal goals of the Phase 1 and Phase 2 studies were, respectively: (1) to establish the validity of predicting strength from nondestructive measurements and to select an optimum combination of sample configuration - test method - sample preparation technique for use in Phase 2 and 3 and, (2) to study the effects of aggregate type, water:cement ratio, and cement factor on the prediction of long term strength from early time pulse velocity measurements. A recommended Phase 3 work plan is presented in Appendix B(Volume 2). GRA

N76-18551# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/ Materials Directorate.

ANALYSIS OF SHELLS OF REVOLUTION BY A CURVED FINITE ELEMENT

Ju-Chin Huang and Charles M. Eldridge 30 May 1975 46 p refs
(AD-A016877; RL-75-10) Avail: NTIS CSCL 12/1

This report involves the development of a curved finite element for the analysis of symmetrically loaded shells of revolution with transverse shear effects. The shell displacements are written in local rectilinear coordinates. They are represented by four-degrees of freedom at a node, two translations and two rotations. The geometric approximation of the curved shell element is similar to that given by Khojasteh-Bakht in 'Analysis of Elastic-Plastic Shells of Revolution Under Axisymmetric Loading by the Finite Element Method.' The equilibrium equations governing the shell behavior were derived by the principle of minimum total potential energy. Several selected numerical examples were solved and the solutions are in excellent agreement with known results. Author (GRA)

N76-18552# Army Materials and Mechanics Research Center, Watertown, Mass.

UTILIZATION OF THE BEND TEST FOR DETERMINING TENSILE PROPERTIES OF A BRITTLE MATERIAL Final Report

John Campo Aug. 1975 28 p
(AD-A016129; AMMRC-TR-75-17) Avail: NTIS CSCL 11/2

A limited number of bend as well as tension tests were performed at room temperature on specimens made of Norton HS-130 grade silicon nitride. By application of the two-parameter Weibull analysis for a material governed by volumetric flaw distribution, tensile properties of the specimen, based upon the data of both types of testing, were determined and compared. The results show, at least for the specimens tested, that the bend test tends to predict fracture stresses of the tension specimens approximately 8% higher than those obtained in the actual tension tests. GRA

N76-18553# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

FAILURE MECHANISMS IN COMPOSITE SYSTEMS Final Report, 1 Jun. 1974 - 1 Jun. 1975

R. F. Karlak and F. W. Crossman Aug. 1975 133 p refs
(Contract N00019-74-C-0339)
(AD-A015885; LMSC-D457462) Avail: NTIS CSCL 11/4

The off-axis mechanical properties of boron-aluminum unidirectional laminae were theoretically evaluated by finite-element analysis employing generalized plane-strain with in-plane shear. Analyses were performed with a computer program capable of calculating elastic, plastic, and creep deformations as well as interface stresses induced by either mechanical loading or differential thermal displacements. GRA

N76-18554# Stanford Univ., Calif. Dept. of Applied Mechanics.

ON THE EFFECT OF BONDING IN A LAMINATED COMPOSITE Interim Report

May 1975 34 p
(Contract N00014-67-A-0112-0065; Grant AF-AFOSR-2669-74; AF Proj. 9782)
(AD-A015878; SUDAM-75-2; AFOSR-75-1273TR) Avail: NTIS CSCL 11/4

The influence of the degree of bonding (ranging from perfect bond to smooth contact) between the matrix and the reinforcing layers on an unbounded, laminated, composite medium in plane strain is investigated. To this end springs are introduced between each layer. The governing equations are established within the framework of Effective Stiffness Theory. The effect of the degree of bonding on the dispersion relations of longitudinal and transverse plane harmonic waves propagating along and normal to the layering is determined. Author (GRA)

N76-18555# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.

IMPACT STRENGTH OF ANGLE PLY FIBER REINFORCED MATERIALS Interim Report, 1974 - 1975

J. M. Lifshitz Sep. 1975 47 p refs
(Grant AF-AFOSR-2607-74; AF Proj. 9782)
(AD-A015847; MED-49; SR-7; AFOSR-75-1449TR) Avail: NTIS CSCL 11/4

Tensile strength of angle ply balanced laminates made of glass fibers and epoxy matrix has been investigated under impact loading. An instrumented drop weight apparatus was used to apply the load and measure stress and strain during the impact process. Theoretical stress-strain curves are compared to experimental ones. Good agreement is shown to exist for fiber

orientation above plus or minus 45 degrees while for lower fiber orientation the agreement is only for part of the loading process. It is shown that different failure criteria have to be used for different ranges of fiber orientation. Above plus or minus 40 degrees the experimental failure stresses agree well with theoretical predictions while below this angle the experimental values are supplemented by a qualitative discussion only. Failure stresses in the dynamic case are found to be considerably higher than the corresponding static values for the complete range of fiber orientation. The failure strains and initial effective modulus are the same for static and for impact loadings. GRA

N76-18556# Wisconsin Univ., Madison. Mathematics Research Center.

APPLICATION OF THE THEORY OF SLENDER CURVED RODS TO THE ANALYSIS OF ELASTIC YARNS Technical Summary Report

N. C. Huang Jul. 1975 38 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-A016103; MRC-TSR-1550) Avail: NTIS CSCL 11/5

This report summarizes recent work of the author on the application of the theory of slender curved rods to the extension of long elastic filament yarns. A formulation of a linear theory of slender curved rods is given, the rod being treated as a one-dimensional body, and this theory is then applied to investigate the small extension of two-ply and continuous filament yarns. The filaments in the yarns are treated as elastic slender curved rods with the center line of the rod lying along a circular helix. The yarn elongation and filament stresses are analyzed for yarns with various geometrics, the ends of the yarns being clamped or free. The effect of the superposition of a twisting moment on the axial extension is also discussed. In comparison with previous work on similar problems for yarns the method of the report requires fewer assumptions and approximations and can provide better geometrical and physical insights. GRA

N76-18557# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

EFFECT OF PLASTIC PRESTRAIN ON THE TENSILE STRAIN TO FAILURE OF BERYLLIUM Interim Report, Jul.-Dec. 1974

T. Nicholas Jun. 1975 25 p refs

(AF Proj. 7351)

(AD-A015729; AFML-TR-75-52) Avail: NTIS CSCL 20/11

Results of tensile tests on specimens of CIP/HIP P-1 beryllium previously prestressed into the plastic range are presented. Two types of prior deformation are considered, a plastic precompression and a plastic pretension followed by plastic compression. Data from tests involving levels of prestress between 40 and 55 ksi (276 and 379 MPa) show no reduction in the uniaxial tensile strain to failure as a result of prior plastic deformations as high as one percent. An increase in tensile flow stress is observed for the precompressed specimens. Author (GRA)

N76-18558# Aerospace Corp., El Segundo, Calif. Lab. Operations.

STATISTICAL FRACTURE OF BRITTLE MATERIALS: PROGRESS ON J. O. 5628 DURING FY75 AND PLANS FOR FY76 Interim Report

Samuel B. Batdorf, Richard H. Huddlestone, and David C. Pridmore-Brown 2 Sep. 1975 77 p refs

(Contract F04701-75-C-0076)

(AD-A015864; TR-0076(9990)-1; SAMSO-TR-75-222) Avail: NTIS CSCL 20/11

The reasons why an improved understanding of the statistics of failure of brittle materials is important to the armed services are briefly reviewed. In addition, the status of work at Aerospace prior to undertaking the present work, which is supported by the Office of Naval Research and the Air Force Office of Scientific Research, and the technical proposal are reviewed. The tasks accomplished in FY 75 are discussed in some detail in Section II, subject to the limitation that this report was prepared two months prior to the end of the fiscal year. The major items of interest are: (1) a literature search for fracture data useful for validating or correcting theories, (2) recent discoveries that relate the theory for surface-distributed cracks to that for volume-distributed cracks, (3) work on the graphite model of Buch, Zimmer, and Meyer, (4) effects of porosity and crack interaction, and (5) the significance of asymptotic forms (such as the Weibull theory) in extreme value statistics. GRA

N76-18559# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

TRANSIENT RESPONSE OF AN ELASTIC HALF SPACE TO AN IMBEDDED CYLINDRICAL LOAD BY A TWO-SPATIAL CHARACTERISTICS COMPUTER CODE

M. Ziv May 1975 191 p refs

(Grant AF-AFOSR-2330-72; AF Proj. 9782)

(AD-A015866; TAE-250; AFOSR-75-1275TR) Avail: NTIS CSCL 20/11

Stress wave propagation in a quarter-plane is presented here via the configuration of the following boundary value problem: The transient motion of an elastic half-space is considered, where an impulsive load is applied to the boundary of a cylindrical cavity embedded in the half-space. The cylindrical cavity extends from the free surface of the half-space into its infinite interior and the load is uniformly and radially distributed over the entire boundary of the cavity. The method consists of superimposing compatible kinematical relations, existing across strong discontinuity surfaces, on the multi-dimensional theory of characteristics. A wave grid is then constructed and the integration along these fronts is carried out numerically using the finite-difference technique. Although this method has already been established by the author it is repeated here in a modified version, for the sake of clarity. Stress distribution and velocity of the particles as well as longitudinal, shear, and head waves are revealed in the solution of the elastic quarter-plane. For the solution a new computer program is developed. The computer output consists of two kinds of lists and three kinds of plots for the variables. GRA

N76-18560# Naval Ship Research and Development Center, Bethesda, Md.

AN UPDATED GUIDE TO THE USE OF GENERAL BENDING RESPONSE PROGRAM (GBRP) Research and Development Report

Michael E. Golden and Francis M. Henderson Apr. 1975 153 p refs

(SF53532701)

(AD-A015948; NSRDC-4601) Avail: NTIS CSCL 20/11

A new version of General Bending Response Program, a computer program for ship vibration analysis, has been established on the Center's CDC computing system. This version differs from former versions primarily by permitting users to dynamically adjust computer core to fit the needs of any particular application. The report documents the use of the program to: (1) calculate the vibratory forces in a propeller shaft; (2) check the accuracy of normal mode shapes computed with the program's natural frequency option; and (3) obtain SC-4020 plots of computed results. Sample problems demonstrate each of these applications. Author (GRA)

N76-18561# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

NOTE ON AXIAL-SHEAR AND CONTOUR VIBRATIONS OF PRISMS

R. D. Mindlin May 1975 26 p refs

(Contract N00014-67-A-0108-0027; NR Proj. 064-388)

(AD-A015663; TR-31) Avail: NTIS CSCL 20/11

Exact solutions of the equations of the linear theory of elasticity are given for axial-shear modes of vibration of an isotropic, prismatic bar whose normal section is an equilateral triangle or has the equilateral triangle as a module. A family of contour modes is also described for bars with a rhombic section formed of two equilateral triangles and with sections having the rhombus as a module. Author (GRA)

N76-18562# California Univ., Berkeley. Dept. of Mechanical Engineering.

ON THE FORMULATION OF CONTACT PROBLEMS OF SHELLS AND PLATES

P. M. Naghdi Sep. 1975 40 p refs

(Contract N00014-75-C-0148; NR Proj. 064-436)

(AD-A016056; AM-75-2) Avail: NTIS CSCL 20/11

The equations of motion in terms of resultants and the

constitutive equations in the theory of shells and plates are ordinarily derived from the three-dimensional equations relative to an interior surface, often taken to be the middle surface in the reference configuration of the shell-like body. This usual formulation is not, in general, applicable to contact problems of shells for which one of the major surfaces, e.g., the upper surface, is specified as the reference surface. The present paper is concerned with the transformation relations between the relevant variables (and hence also the response functions) of the traditional formulation and one which can be obtained relative to one of the major surfaces. GRA

N76-18563# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
INELASTIC BUCKLING OF PLATES ALLOWING FOR SHEAR EFFECTS
Suresh Chandra Shrivastava and Hans H. Bleich Jul. 1975 110 p refs
(Contract N00014-75-C-0695; NR Proj. 064-428)
(AD-A015671; TR-49) Avail: NTIS CSCL 20/11

The inelastic buckling including the effects of transverse shear is analyzed for flat rectangular plates in uniform uniaxial compression. Using a hardening material obeying the von Mises yield condition, the problem is treated according to both the incremental and deformation theories of plasticity. The analysis is based on Shanley's concept of continuous loading. Using boundary conditions which permit separation of variables it becomes possible to solve the resulting ordinary differential equations by asymptotic approximations giving closed form expressions for the critical loads. The correction terms due to shear effects were obtained for infinitely long, and for square, simply supported plates, and for infinitely long ones, simply supported on three sides and free on one unloaded edge. The analysis presented is also suitable for sandwich plates.
Author (GRA)

42 GEOSCIENCES (GENERAL)

N76-18564# Joint Publications Research Service, Arlington, Va.
METEOROLOGY AND HYDROLOGY, NO. 9, 1975
Ye. I. Tolstikov, ed. 29 Dec. 1975 185 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 6-111
(JPRS-66453) Avail: NTIS HC $7.50

Articles are presented concerning microclimate, agricultural meteorology, weather forecasting and climate control, hydrological forecasting, the activities and personnel of the Soviet Hydrometeorological Service, and new publications. For individual titles, see N76-18565 through N76-18576.

N76-18565 Joint Publications Research Service, Arlington, Va.
FORECASTING METEOROLOGICAL ELEMENTS OVER A LIMITED TERRITORY BY THE PRIMITIVE EQUATIONS **c47**
V. P. Dymnikov, G. R. Kontarev, N. V. Guseva, I. V. Kolotovkin, A. G. Kulinych, N. P. Gazetova, G. V. Shemetova, L. Ye. Kaminskaya, and Z. V. Kaminskaya *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 4-14 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 6-13 (For availability see N76-18564 09-42)

The set of algorithms and programs is presented of the nonadiabatic scheme for short-range weather forecasting over a limited territory by the primitive equations of hydrothermodynamics. The lee time of the forecast is 48 hours. The phase heat fluxes are used as the nonadiabatic fluxes. In addition to the temperature, wind and geopotential fields, the dewpoint deficit field, the field of stratiformis cloudiness (with definition of its boundaries), and the steady rain fields are precalculated, and the parametrization of the boundary layer is carried out. The results are presented from some operative tests. The model is being used under operative conditions in the Western Siberian regional hydrometeorological center. Author

N76-18566 Joint Publications Research Service, Arlington, Va.
DAMPING OF THE GRAVITY WAVES IN THE ATMOSPHERE UNDER THE EFFECT OF THE PLANETARY BOUNDARY LAYER **c46**
V. M. Kadyshnikov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 15-23 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 14-20 (For availability see N76-18564 09-42)

On the basis of solving the linearized equations of a barotropic atmosphere, the frequency of the gravity waves propagated through a sphere is determined. The comparison of the solution to the equations considering and not considering the presence of the planetary boundary layer in the atmosphere permits analysis of the dependence of the frequency on the turbulent viscosity, in particular, estimation of how this factor affects the wave damping and the decrease in their phase velocity. Author

N76-18567 Joint Publications Research Service, Arlington, Va.
ROLE OF ATMOSPHERIC FRONTS AND SOME CIRCULATION FACTORS IN THE DEVELOPMENT OF CONVECTION **c47**
A. I. Buz *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 24-37 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 21-30 (For availability see N76-18564 09-42)

On the basis of the study of certain characteristics of atmospheric fronts and the baric field, it is demonstrated that the horizontal temperature contrast and the degree of baroclinicity contain little information with respect to the development of atmospheric convection. The excitation of powerful atmospheric convection takes place under the effect of ordered ascending movements caused by wind convergence in the friction layer. Examples are presented indicating the effect of the mesoscale ascending movements on the atmospheric convection. Author

N76-18568 Joint Publications Research Service, Arlington, Va.
LOW-LATITUDE TROPOSPHERIC CIRCULATION MODEL **c46**
L. Kh. Ingel *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 38-46 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 31-38 (For availability see N76-18564 09-42)

New classes of analytical solutions for the system of equations of dynamics of the atmosphere in the equatorial zone are presented. Author

N76-18569 Joint Publications Research Service, Arlington, Va.
INTERHEMISPHERE DIFFERENCES IN THE WIND FIELD AT ALTITUDES OF 25 - 80 km **c47**
Yu. P. Koshelkov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 47-52 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 39-43 (For availability see N76-18564 09-42)

The differences between the wind velocities at altitudes of 25-80 km in the Northern and Southern Hemispheres are defined at all latitudes for different months. A comparison of the mean distribution of the zonal wind velocity to the south and north of the equator in the 25-80 km layer reveals the significant interhemispherical differences to 30 m/sec in the summer and 60 m/sec in the winter. These differences are connected with the peculiarities of the temperature distribution in the Northern and Southern Hemispheres. Author

N76-18570 Joint Publications Research Service, Arlington, Va.
RELATIVE TOTAL RADIATION AS A CLIMATIC CHARACTERISTIC OF CLOUDS **c47**
O. S. Lvova *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 53-61 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 44-51 (For availability see N76-18564 09-42)

The stability of the relative total radiation Q* of pure forms of Ci, St and Ns clouds both in the frequency distributions and in the mean Q* and sigma is proved using data of guaranteed probability. The low dependence of Q* on the latitude and season (winter, summer) is demonstrated. The frequency distribution curves of Q* generalized according to nine points in the European Territory of the U.S.S.R. are presented for the indicated clouds. Author

N76-18571 Joint Publications Research Service, Arlington, Va.
SIMULATION OF URBAN ATMOSPHERIC POLLUTION FROM A SERIES OF CONTINUOUS ELEVATED SOURCES **c45**
N. S. Veltishcheva *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 62-71 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 52-58 (For availability see N76-18564 09-42)

A general statement of the problem of forecasting urban atmospheric pollution is presented on the basis of the numerical forecasting of the meteorological elements considering the structure of the boundary layer. The results of the experiments in simulating the transport of the impurities from a series of continuous sources are presented. Author

N76-18572 Joint Publications Research Service, Arlington, Va.
PROBLEM OF RESERVOIR HYDRAULICS **c43**
G. A. Urlapov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 83-97 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 68-78 (For availability see N76-18564 09-42)

The basic hydraulic parameters are defined for a nonuniform flow along the length of the reservoir with one current, and a settling pond. The interrelation of the hydraulic parameters of the flow and the morphological characteristics of the reservoir are obtained without using the relation characteristics of the uniform movement of the flow. A study was made of the numerical example of calculating the deposition of alluvium by fractions in a comparison of the calculated results and the measured result. Some recommendations are made with respect to the planning, design and operation of the reservoirs. Author

N76-18573 Joint Publications Research Service, Arlington, Va.
METHODS OF CALCULATING THE INTERACTING ADJACENT FLOWS IN RECTILINEAR SECTIONS **c34**
V. A. Rozanov *In its* Meteorology and Hydrol., No. 9 (JPRS-66543) 29 Dec. 1975 p 108-115 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 86-91 (For availability see N76-18564 09-42)

Methods of calculating the interacting adjacent flows in rectilinear sections are presented. The experimental data obtained in the water research laboratory of the Leningrad Hydrometeorological Institute is analyzed. The hydraulic drag of the interacting adjacent flows which depends on the velocity difference of the adjacent flows and the angle of the velocity vector in the flow interaction zone is reflected in the calculations of the flows. It was necessary to consider three types of the interaction for the hydraulic calculations. Author

N76-18574 Joint Publications Research Service, Arlington, Va.
CALCULATING THE SOIL TEMPERATURE FOR THE COLD SEASON **c46**
E. G. Palagin and L. N. Gutman *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 116-129 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 92-101 (For availability see N76-18564 09-42)

A method is proposed for calculating the soil temperature and the freezing depth by the data on the air temperature at the level of the meteorological screen, the thickness of the snow cover, the turbulence parameters of the atmosphere, the thermophysical and moisture characteristics of the soil and the snow. The model permits warmings, appearance, and the disappearance of the snow cover. An example calculation is given, and a comparison with the observation data in nature is presented. Author

N76-18575 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF USING THE DATA FROM THE ROCKET METEOROLOGICAL SOUNDING NETWORK IN LONG RANGE FORECASTING **c47**
I. V. Bugayeva, G. A. Kokin, V. S. Purganskiy, L. A. Ryazanova, and D. A. Tarasenko *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 130-138 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 102-106 (For availability see N76-18564 09-42)

The possibilities of using the information received from the rocket sounding station network to forecast large-scale atmospheric processes were studied. An effort is made to find the predictors for the interseason and intraseason rearrangements. Author

N76-18576 Joint Publications Research Service, Arlington, Va.
AMERICAN RESEARCH ON THE WEATHER MODIFICATION PROBLEM **c47**
Yu. S. Sedunov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 139-148 Transl. into ENGLISH from Meteorol. i Gidrol (Moscow), no. 9, 1975 p 107-111 (For availability see N76-18564 09-42)

On the basis of the materials and the impressions obtained during visits by a group of Soviet specialists to a number of scientific institutions of the United States dealing with the problem of weather modification, the organization of operations, the basic plans and research performed by these institutions are described. A brief characteristic is presented of the reports submitted at the Fourth National Conference in the United States on weather modification. Conclusions are drawn regarding the peculiarities and the trends in the development of the work in the field of modifying meteorologic processes. Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-18577 Colorado State Univ., Fort Collins.
REMOTE SENSING OF SELECTED BIOLOGICAL PHENOMENA IN LODGEPOLE PINE Ph.D. Thesis
John Raymond Daugherty 1975 89 p
Avail Univ. Microfilms Order No. 76-4306

Samples of transpiration rate (TR), moisture stress level (MSL), crown surface temperature, crown air temperature, relative humidity, phenological date, ambient air temperature, and suntime were measured in the lodgepole pine forest of the Little South Fork Experimental Watershed. The purpose was to establish patterns of TR and MSL in relation to variation of the other parameters and to develop models to predict TR and total water loss amounts and MSL over a given period of the summer in the sample trees utilizing a variety of combinations of the other parameters. Data analysis show that crown surface temperature is more highly correlated with TR and MSL than was crown air temperature in a previous study. A set of equations for prediction of TR and MSL was produced allowing all the variables into the calculations. Dissert. Abstr.

N76-18578*+ National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 6, DECEMBER 1975
Dec. 1975 122 p
(NASA-SP-7041(06)) Avail: NTIS HC $4.50 CSCL 05B

This bibliography lists 484 reports, articles, and other documents introduced into the NASA scientific and technical information system between April 1975 and June 1975. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N76-18579*# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF THE EFFECTS OF CONSTRUCTION AND STAGE FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ENERGY Final Report
Ravinder K. Jain, Principal Investigator and Robert E. Riggins Dec. 1975 97 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10158; NASA-CR-146362) Avail: NTIS HC $5.00 CSCL 13B

There are no author-identified significant results in this report.

N76-18580*# Geological Survey, Miami, Fla.
THE APPLICATION OF LANDSAT DATA FROM COLLECTION PLATFORMS AND LANDSAT IMAGERY FOR FIRE MANAGEMENT, EVERGLADES NATIONAL PARK, FLORIDA Progress Report
A. L. Higer, Principal Investigator, L. J. Swayge, W. L. Bancroft, and E. H. Cordes Oct. 1975 16 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10159; NASA-CR-146363) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-18581*# Earth Satellite Corp., Washington, D.C.
STUDY OF MESOSCALE EXCHANGE PROCESSES UTILIZING LANDSAT AIR MASS CLOUD IMAGERY Interim Report, Dec. 1975 - Feb. 1976
Earl S. Merritt and Romeo R. Sabatini, Principal Investigators Feb. 1976 8 p ERTS
(Contract NAS5-20944)
(E76-10160; NASA-CR-146364) Avail: NTIS HC $3.50 CSCL 04B

There are no author-identified significant results in this report.

N76-18582*# Geological Survey, Tacoma, Wash.
SKYLAB FLOATING ICE EXPERIMENT Final Report
W. J. Campbell, Principal Investigator, R. O. Ramseier (Dept. of the Environment, Ottawa, Canada), R. J. Weaver (Dept. of the Environment, Ottawa, Canada), and W. F. Weeks (Army Cold Regions Res. and Engr. Lab., Hanover, N. H.) Dec. 1975 67 p refs EREP
(NASA Order T-4111-B)
(E76-10161; NASA-CR-147446) Avail: NTIS HC $4.50 CSCL 08L

The author has identified the following significant results. Coupling of the aircraft data with the ground truth observations proved to be highly successful with interesting results being obtained with IR and SLAR passive microwave techniques, and standard photography. Of particular interest were the results of the PMIS system which operated at 10.69 GHz with both vertical and horizontal polarizations. This was the first time that dual polarized images were obtained from floating ice. In both sea and lake ice, it was possible to distinguish a wide variety of thin ice types because of their large differences in brightness temperatures. It was found that the higher brightness temperature was invariably obtained in the vertically polarized mode, and as the age of the ice increases the brightness temperature increases in both polarizations. Associated with this change in age, the difference in temperature was observed as the different polarizations decreased. It appears that the horizontally polarized data is the most sensitive to variations in ice type for both fresh water and sea ice. The study also showed the great amount of information on ice surface roughness and deformation patterns that can be obtained from X-band SLAR observations.

N76-18583*# Iowa Geological Survey Remote Sensing Lab.
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Progress Report, 3 Aug. - 3 Oct. 1975
James R. Lucas, Principal Investigator, James V. Taranik (EROS Data Center, Sioux Falls, S. D.), and Frederic C. Billingsley (JPL) 3 Nov. 1975 51 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20832)
(E76-10162; NASA-CR-146365; Rept-3) Avail: NTIS HC $4.50 CSCL 08B

The author has identified the following significant results. Two enhanced false color negatives from multispectral scanner scenes, dated 15 April 1974 and 29 August 1972, were printed at a scale of 1:125,000 to form the basis for land use interpretations in the Wapello County, Iowa test site. The use of geomorphic principles proved valuable in the interpretation of the April scene to form valuable generalizations for planning purposes on soil associations, topography, alluvial valleys, and agricultural land use. The August scene was superior in providing information on urban extent, transportation networks, forest cover, and water bodies.

N76-18584*# California Univ., Berkeley. Space Sciences Lab.
AGRICULTURAL INTERPRETATION TECHNIQUE DEVELOPMENT Final Report, 1 Jun. 1973 - 31 Jul. 1975
Robert N. Colwell, Principal Investigator, Andrew S. Benson, Catherine E. Brown, Claire M. Hay, David M. Huston, Nancy A. Jones, James D. Nichols, and Randall W. Thomas 31 Jul. 1975 258 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14419)
(E76-10163; NASA-CR-144486; SSL-Ser-16-Issue-77) Avail: NTIS HC $9.00 CSCL 02C

The author has identified the following significant results. Highly useful agricultural land use classifications can be accomplished on S-190 A and B photography. Of the two film types available, viz., natural color and false color infrared, false color infrared photography was found to be the more useful for determining stratification units. Through the use of point sampling techniques on both single and multidate S-190A false color infrared photography, estimates were made of irrigated lands on four test sites in the San Joaquin Valley, California. A multidate photointerpretation technique was developed to inventory cotton with S-190A and S-190B photography from the Skylab 2 and 3 missions. The photographic point sample plan and estimation models were designed so that their most efficient applications would be for organizations with limited automatic processing facilities. The S-192 data from the three Skylab missions were analyzed using the CALSCAN program to determine the optimum four-channel combinations for classifying agricultural crops in the San Joaquin Valley. Based on the results, it was concluded that the optimum feature combination for classifying the agricultural complex in California would be features 4, 7, 9, and 11.

N76-18585*# Maryland Geological Survey, Baltimore.
INVESTIGATION OF THE GEOLOGY, MINERAL RESOURCES AND WATER RESOURCES OF THE STATE OF MARYLAND Final Report
Kenneth N. Weaver, Principal Investigator Nov. 1975 21 p refs EREP
(Contract NAS9-13294)
(E76-10164; NASA-CR-144470) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-18586*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report
Saul Cooper, Principal Investigator [1975] 7 p refs ERTS
(E76-10165; NASA-CR-146366; PR-3) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The demonstration, local user terminal, has proven the hypothesis that a relatively inexpensive, automatic, and easily maintained ground receiving station for satellite relayed data is practical for an operational use.

N76-18587*# California Earth Science Corp., Santa Monica.
FAULT TECTONICS AND EARTHQUAKE HAZARDS IN THE PENINSULAR RANGE, SOUTHERN CALIFORNIA
Paul M. Merifield, Principal Investigator 10 Feb. 1976 5 p refs EREP
(Contract NAS2-7698)
(E76-10166; NASA-CR-146367; MPR-32) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-18588*# Old Dominion Univ. Research Foundation, Norfolk, Va.

THE USE OF ERTS-1 TO MORE FULLY UTILIZE AND APPLY MARINE STATION DATA TO THE STUDY AND PRODUCTIVITY ALONG THE EASTERN SHELF WATERS OF THE UNITED STATES Final Report, Aug. 1972 - Dec. 1974

Harold G. Marshall, Principal Investigator, David E. Bowker (NASA. Langley Res. Center), and William G. Witte (NASA. Langley Res. Center) Feb. 1976 48 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21816)

(E76-10167; NASA-CR-146368) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. Sea truth data were obtained during two ERTS overpasses in waters near the entrance of the Chesapeake Bay. Correlations were made between total phytoplankton and chlorophyll values in these waters to radiance detected by ERTS in an effort to map areas of similar productivity levels. Band 4 radiance had the highest correlation to all parameters with bands 5 and 6 showing decreasing correlations in each case. The radiance values were apparently influenced by one or more factors, most likely including the sediment content of the water. Data have shown that ERTS MSS is not suitable for monitoring chlorophyll in near-shore waters where sediment loads are high. It is suggested that in more seaward or pelagic locations, that ERTS MSS would be more efficient in monitoring surface chlorophyll values and establishing direct relationships to phytoplankton concentrations.

N76-18589*# Tri-State Regional Planning Commission, New York.

INVESTIGATION OF SATELLITE IMAGERY FOR REGIONAL PLANNING Final Report, 1972 - 1974

William Harting, Principal Investigator Aug. 1975 72 p ERTS (Contract NAS5-21738)

(E76-10168; NASA-CR-146369) Avail: NTIS HC $4.50 CSCL 08B

The author has identified the following significant results. Satellite multispectral imagery was found to be useful in regional planning for depicting general developed land patterns, wooded areas, and newly constructed highways by using visual photointerpretation methods. Other characteristics, such as residential and nonresidential development, street patterns, development density, and some vacant land components cannot be adequately detected using these standard methods.

N76-18590*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: MULTIDISCIPLINARY APPLICATION OF LANDSAT-2 DATA TO MARINE ENVIRONMENT IN CENTRAL JAPAN

Takakazu Maruyasu, Principal Investigator and Hiroaki Ochiai (Toba Merchant Marine Coll., Toba-shi, Japan) [1976] 17 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10169; NASA-CR-146155) Avail: NTIS HC $3.50 CSCL 08A

The author has identified the following significant results. The multidisciplinary application of multispectral scanner data acquired over central Japan revealed several coastal features including pollution, river effluent, shorelines, red tide, etc. Supporting data were obtained by airborne remote sensing.

N76-18591*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: CLASSIFICATION OF SHORELINES Quarterly Report

Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 3 Feb. 1976 8 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10170; NASA-CR-146370) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. It was found in the band 7 that the image density of some parts of reclaimed lands had the same density with that of the sea.

N76-18592*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: INVESTIGATION OF VARIATIONS IN THE PROMINENT OCEANIC CURRENT, KUROSHIO Quarterly Report

Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 3 Feb. 1976 6 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. ERTS

(E76-10171; NASA-CR-146371) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. In the print of MSS band 4 of Shiono Misaki and Ise taken by LANDSAT on 11 September 1975, different water masses can be recognized distinctly. At 35 miles off Shiono Misaki, a vortex pattern is found which has an ellipsoidal shape with a diameter of 30 miles and appears to rotate counterclockwise. In Ise, water masses were found spreading widely along the coast from the mouth of Ise Bay. The temperature of sea surface obtained from sea truth shows almost a uniform pattern. The distribution of surface salinity and transparency shows a distinct pattern.

N76-18593*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: INVESTIGATION OF SOIL EROSION IN HOKKAIDO WHICH IS CAUSED BY THAWING OF SOIL WATER IN LATE SPRING Quarterly Progress Report, Oct. 1975 - Jan. 1976

Takasazu Maruyasu and Shigechika Hayashi, Principal Investigators (Natl. Agricultural Experiment Station, Hokkaido, Japan) Jan. 1976 3 p Sponsored by NASA and Sci. and Technol. Agency, Japan Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10172; NASA-CR-146372) Avail: NTIS HC $3.50 CSCL 08M

There are no author-identified significant results in this report.

N76-18594*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: INVESTIGATION OF THE ECOLOGICAL ENVIRONMENT INDEX FROM OBSERVATION OF THE REGIONAL VEGETATION COVER AND THEIR GROWING CONDITION Quarterly Progress Report

Takakazu Maruyasu and Iwao Vakajima, Principal Investigators (Government Forest Experiment Station, Tokyo) [1976] 2 p Sponsored by NASA ERTS

(E76-10173; NASA-CR-146373) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-18595*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN: A STUDY ON CHANGE DETECTION OF LAND COVER IN TOKYO DISTRICTS USING MULTI-DATES LANDSAT CCT Quarterly Report

Takakazu Maruyasu and Shunji Murai, Principal Investigators (Tokyo Univ., Japan) 9 Jan. 1976 9 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10174; NASA-CR-146374) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. The software program, which enables the geographically corrected LANDSAT digital data base, was developed. The data base could provide land use planners with land cover information and the environmental change pattern. Land cover was evaluated by the color representation for ratio of three primary components, water vegetation, and nonorganic matter. Software was also developed for the change detection within multidates LANDSAT MSS data.

N76-18596*# Science Univ. of Tokyo (Japan).

INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN

IN JAPAN: APPLICATION OF LANDSAT-2 DATA FOR UNDERSTANDING ENVIRONMENTAL CHANGES IN THE COASTAL AND OF SHORE ZONE Quarterly Progress Report, Oct. - Dec. 1975
Takakazu Maruyasu and Kiyoshi Tsuchiya, Principal Investigators (National Space Development Agency, Tokyo) 31 Jan. 1976 4 p Sponsored by NASA and Sci. and Technol. Agency, Japan ERTS
(E76-10175; NASA-CR-146375) Avail: NTIS HC $3.50 CSCL 08J

There are no author-identified significant results in this report.

N76-18597*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Oct. - Dec. 1975
R. A. Halliday, Principal Investigator and I. A. Reid Jan. 1976 10 p Sponsored by NASA ERTS
(E76-10176; NASA-CR-146376) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. The project demonstrates the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data on a quasi-operational basis. The implementation of the Alaska receive site in December had a significant impact on the Canadian experiment as the number of transmissions now received from some northern sites has increased substantially. Data are now received on as many as 11 orbits each day.

N76-18598*# Geological Survey, Reston, Va.
OVERALL EVALUATION OF SKYLAB (EREP) IMAGES FOR CARTOGRAPHIC APPLICATION Final Report
Alden P. Colvocoresses, Principal Investigator 15 Dec. 1975 22 p refs EREP
(NASA Order T-5395-B)
(E76-10177; NASA-CR-147423) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-18599*# West Virginia Dept. of Natural Resources, Charleston.
CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Jun. - 19 Dec. 1975
Ira S. Latimer, Jr., Principal Investigator 19 Jan. 1976 3 p ERTS
(E76-10178; NASA-CR-146377) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-18600*# Colorado School of Mines, Golden. Dept. of Geology.
EVALUATION OF SKYLAB S190-A PHOTOS FOR ROCK DISCRIMINATION AND COMPARISON WITH ERTS IMAGERY
Kennan Lee, Principal Investigator and Daniel H. Knepper Dec. 1975 29 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13394)
(E76-10179; NASA-CR-146378; Rept-75-4) Avail: NTIS HC $4.00 CSCL 08G

There are no author-identified significant results in this report.

N76-18601*# Arkansas Univ., Fayetteville. Dept. of Geology.
LAND USE CHANGE DETECTION WITH LANDSAT-2 DATA FOR MONITORING AND PREDICTING REGIONAL WATER QUALITY DEGRADATION Quarterly Progress Report, 28 Oct. 1975 - 27 Jan. 1976
H. C. MacDonald, Principal Investigator and K. F. Steele Feb. 1976 11 p ERTS
(Contract NAS5-20810)
(E76-10180; NASA-CR-146379) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-18602*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
CASE STUDIES ON THE GEOLOGICAL APPLICATION OF LANDSAT IMAGERY IN BRAZIL
Fernando DeMendonca, Principal Investigator, Aderbal C. Correa, and Chan C. Liu Aug. 1975 37 p refs Sponsored by NASA Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10181; NASA-CR-146380; INPE-729-PE/006) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Sao Domingos Range, Pocos de Caldas, and Araguaia and Tocantins Rivers in Brazil were selected as test sites for LANDSAT imagery. The satellite images were analyzed using conventional photointerpretation techniques, and the results indicate the application of small scale image data in regional structural data analysis, geological mapping, and mineral exploration.

N76-18603*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
SOME RESULTS ON THE USE OF THE LANDSAT-1 MULTISPECTRAL IMAGES
Rene A. Novaes, Principal Investigator 28 May 1975 12 p Presented at the Earth Resources Survey Symp., Houston Sponsored by NASA ERTS
(E76-10182; NASA-CR-146381; INPE-659-RRE/006) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-18604*# Zurich Univ. (Switzerland).
FOUR CONTRIBUTIONS TO THE SWISS ERTS AND EREP SATELLITE PROJECT
Harold Haefner, Principal Investigator, Bruno Messerli, Matthias Winiger, Rudolf Gfeller, Klaus Seidel, and Urs Geiser 1975 19 p refs Repr. from Geographica Helvetica (Switzerland), no. 3, 1975 p 97-114 In GERMAN Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10183; NASA-CR-146279) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-18605*# Houston Univ., Tex. Wave Propagation Lab.
CROSS-CORRELATIVE ANALYSIS OF S-193 DATA FOR TERRAIN CHARACTERISTICS Final Report
H. S. Hayre, Principal Investigator 15 Aug. 1975 39 p EREP
(Contract NAS9-13462)
(E76-10184; NASA-CR-144501; TR-75-9) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. The impulse response technique, when coupled with fine resolution altimeter data, is capable of yielding: (1) very fine mean ground elevation resolution; (2) slopes and slope variation along the altimeter path; (3) the absorption or the ground vegetation cover density for a given weather condition; and (4) an eventual classification of ground cover and/or moisture content of the ground.

N76-18606*# North Carolina State Univ., Raleigh. Dept. of Geosciences.
UTILIZATION OF EREP DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Final Report, Mar. 1973 - Oct. 1975
Charles W. Welby, Principal Investigator and J. O. Lammi Oct. 1975 211 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13321)
(E76-10185; NASA-CR-144104) Avail: NTIS HC $7.75 CSCL 08F

The author has identified the following significant results. The S190A, S190B, and S192 photographs and imagery were studied, using standard air-photo interpretation techniques supplemented by color additive viewing and density slicing. The

EREP data were found to have potential usefulness for natural resource inventory work, water quality monitoring, and land use mapping for specific problems at scales up to 1:30,000. Distinctions between forest types in North Carolina are limited to conifers, mixed conifer-hardwoods, and hardwoods. Geologic interpretation was limited to detection of lineaments; lithologic differentiation and soil group mapping have proved infeasible in North Carolina except for differentiation of wetland soils in the coastal plain. Imagery from the S192 multispectral scanner has proved to be capable of useful discriminations for vegetation and crop analysis.

N76-18607*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
SKYLAB REMOTE BATHYMETRY EXPERIMENT Final Report
Fabian C. Polcyn and David R. Lyzenga Jan. 1976 64 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13278)
(E76-10186; NASA-CR-144482; ERIM-102100-21-F) Avail: NTIS HC $4.50 CSCL 08J

There are no author-identified significant results in this report.

N76-18608*# Kansas Univ., Lawrence.
THE MEASUREMENT OF THE WINDS NEAR THE OCEAN SURFACE WITH A RADIOMETER-SCATTEROMETER ON SKYLAB Final Report, Jan. 1973 - Dec. 1975
Willard J. Pierson, Richard K. Moore, E. Paul McClain, Principal Investigators, Vincent J. Cardone, James D. Young, J. Arthur Greenwood, Catherine Greenwood, Adrian K. Fung, Robert Salfi, H. L. Chan et al 21 Jan. 1976 462 p refs Prepared in cooperation with City Univ. of New York Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13642)
(E76-10187; NASA-CR-147487) Avail: NTIS HC $12.00 CSCL 04B

The author has identified the following significant results. There were a total of twenty-six passes in the ZLV mode that yielded useful data. Six were in the in-track noncontiguous mode; all others were in the cross-track noncontiguous mode. The wind speed and direction, as effectively determined in a neutral atmosphere at 19.5 m above the sea surface, were found for each cell scanned by S193. It is shown how the passive microwave measurements were used both to compute the attenuation of the radar beam and to determine those cells where the backscatter measurement was suspect. Given the direction of the wind from some independent source, with the typical accuracy of measurement by available meteorological methods, a backscatter measurement at a nadir angle of 50, 43, or 32 deg can be used to compute the speed of the wind averaged over the illuminated area.

N76-18609*# Kansas Univ. Center for Research, Inc., Lawrence.
A JOINT METEOROLOGICAL, OCEANOGRAPHIC, AND SENSOR EVALUATION PROGRAM FOR EXPERIMENT S-192 ON SKYLAB: A THEORY OF SEA SCATTER AT LARGE INCIDENT ANGLES
W. J. Pierson (City Univ. of New York), R. K. Moore, Principal Investigators, A. K. Fung, and H. L. Chan Oct. 1975 30 p refs EREP
(Contract NAS9-13642)
(E76-10188; NASA-CR-146286; RSL-TR-254-4) Avail: NTIS HC $4.00 CSCL 08T

There are no author-identified significant results in this report.

N76-18610*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
MULTIPLE RESOURCE EVALUATION OF REGION 2, US FOREST SERVICE LANDS UTILIZING LANDSAT MSS DATA Quarterly Progress Report, 1 Dec. 1975 - 29 Feb. 1976
Paula V. Krebs and Roger M. Hoffer, Principal Investigators (Purdue Univ.) 29 Feb. 1976 27 p refs Prepared in cooperation with Forest Service, Denver ERTS
(Contract NAS5-20948)
(E76-10189; NASA-CR-146287) Avail: NTIS HC $4.00 CSCL 08F

There are no author-identified significant results in this report.

N76-18611*# Naval Research Lab., Washington, D.C.
ANALYSIS OF MICROWAVE RADIOMETRIC MEASUREMENTS FROM SKYLAB
James P. Hollinger, Principal Investigator and Robert M. Lerner Dec. 1975 102 p refs EREP
(NASA Order T-4126-B)
(E76-10190; NASA-CR-147442) Avail: NTIS HC $5.50 CSCL 05B

There are no author-identified significant results in this report.

N76-18612*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OCEAN PROPERTIES Final Report
C. Laurence Korb and John F. Potter, Principal Investigators (Lockheed Electronic Corp., Houston) [1976] 98 p refs ERTS
(E76-10191; NASA-TM-X-72961) Avail: NTIS HC $5.00 CSCL 08J

The author has identified the following significant results. Results of testing the CP program indicate that the best results can be obtained in the near infrared water bands. The absorption due to water vapor and carbon dioxide in the thermal infrared band apperaed to be less reliable in comparison to spacecraft-acquired data and band models. Comparisons of laboratory carbon dioxide transmission in the thermal infrared band show good agreement except in regions where lines are known to be missing. The comparison of ozone transmission at a wavelength of 9.6 micrometers to laboratory data showed unexceptedly large differences.

N76-18613*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
ANALYSIS OF HYDROLOGICAL FEATURES OF PORTIONS OF THE LAKE ONTARIO BASIN USING SKYLAB AND AIRCRAFT DATA Final Report, Mar. 1973 - Dec. 1975
Fabian C. Polcyn, Principal Investigator, Diana L. Rebel, and John E. Colwell Jan. 1976 100 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13275)
(E76-10192; NASA-CR-147456; ERIM-102300-19-F) Avail: NTIS HC $5.00 CSCL 08H

The author has identified the following significant results. S190A and S190B photography proved to be useful for mapping large scale geomorophological features, and for assessing water depth and water quality. Available S192 data were affected by low frequency noise caused by diode light. Hydrological features were classified, and upland green herbaceous vegetation was separated into several classes based on percent vegetation cover. A model for estimating surface soil moisture based on red and near infrared reflectance data was developed and subsequently implemented.

N76-18614*# National Oceanic and Atmospheric Administration, Miami, Fla.
SUMMARY OF RESULTS OF AN EXPERIMENT TO EVALUATE SKYLAB EARTH RESOURCES SENSORS FOR DETECTION OF THE GULF STREAM
George A. Maul, Principal Investigator, Howard R. Gordon, Stephen R. Baig, Michel McCaslin, and Roger J. DeVivo [1975] 2 p Sponsored by NASA EREP
(E76-10194; NASA-CR-146288) Avail: NTIS HC $3.50 CSCL 08J

There are no author-identified significant results in this report.

N76-18615*# National Oceanic and Atmospheric Administration, Boulder, Colo.
THE SKYLAB CONCENTRATED ATMOSPHERIC RADIA-

TION PROJECT Final Report
P. M. Kuhn, W. E. Marlatt (Colorado State Univ., Fort Collins), and V. S. Whitehead, Principal Investigators (NASA. Lyndon B. Johnson Space Center) 1 Sep. 1975 138 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4714-B)
(E76-10195; NASA-CR-144481) Avail: NTIS HC $6.00 CSCL 03B

The author has identified the following significant results. Comparison of several existing infrared radiative transfer models under somewhat controlled conditions and with atmospheric observations of Skylab's S191 and S192 radiometers illustrated that the models tend to over-compute atmospheric attenuation in the window region of the atmospheric infrared spectra.

N76-18616*# Earth Satellite Corp., Berkeley, Calif.
THE USEFULNESS OF SKYLAB/EREP S-190 AND S-192 IMAGERY IN MULTISTAGE FOREST SURVEYS Final Report
Philip G. Langley and Jan VanRoessel, Principal Investigators Jan. 1976 134 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13289)
(E76-10197; NASA-CR-147439; G-091) Avail: NTIS HC $6.00 CSCL 02F

The author has identified the following significant results. The RMSE of point location achieved with the annotation system on S190A imagery was 100 m and 90 m in the x and y direction, respectively. Potential gains in sampling precision attributable to space derived imagery ranged from 4.9 to 43.3 percent depending on the image type, interpretation method, time of year, and sampling method applied. Seasonal variation was significant. S190A products obtained in September yielded higher gains than those obtained in June. Using 100 primary sample units as a base under simple random sampling, the revenue made available for incorporating space acquired data into the sample design to estimate timber volume was as high as $39,400.00.

N76-18617*# Colorado School of Mines, Golden. Dept. of Geology.
EVALUATION OF SKYLAB PHOTOGRAPHY FOR WATER RESOURCES, SAN LUIS VALLEY, COLORADO
Keenan Lee, Principal Investigator and David Huntley Dec. 1975 43 p refs EREP
(Contract NAS9-13394)
(E76-10198; NASA-CR-146289; Rept-75-5) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. Skylab S190A photography used in a stereo mode is sufficient for defining the drainage divides and drainage patterns at the regional level. This data, combined with geologic information, define the boundaries and distribution of ground water recharge and discharge areas within the basin.

N76-18618*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC INTERPRETATION OF SKYLAB PHOTOGRAPHS
Keenan Lee, Principal Investigator and Robert J. Weimer Dec. 1975 85 p refs EREP
(Contract NAS9-13394)
(E76-10199; NASA-CR-146290; Rept-75-6) Avail: NTIS HC $5.00 CSCL 08G

There are no author-identified significant results in this report.

N76-18619*# Delaware Univ., Newark. Coll. of Marine Studies.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS Final Report, 19 Mar. 1973 - 21 Jul. 1975
Karl-Heinz Szekielda, Principal Investigator 31 Jul. 1975 239 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13344)
(E76-10207; NASA-CR-144480; CMS-NASA-C-1-75) Avail: NTIS HC $8.00 CSCL 08A

The author has identified the following significant results. Spectral properties of the upwelled waters off the NW coast of Africa were studied with observations derived from aircraft and Skylab. Results indicate that the two-channel, ratio approach is ineffective in determining surface chlorophyll concentrations. Ocean color boundaries and temperature gradients were found to be directly correlated with each other and also with fishing effort in the upwelling region. Photographic and scanner data derived from Skylab were effective in locating ocean boundaries and mapping temperature distributions.

N76-18620*# Department of the Environment, Ottawa (Ontario).
USE OF SATELLITES IN DATA RETRANSMISSION
R. A. Halliday, Principal Investigator Nov. 1975 23 p refs Sponsored by NASA ERTS
(E76-10208; NASA-CR-146301) Avail: NTIS HC $3.50 CSCL 17B

There are no author-identified significant results in this report.

N76-18621*# Department of the Environment, Ottawa (Ontario).
SOME OPERATIONAL USES OF SATELLITE RETRANSMISSION IN CANADA
R. A. Halliday, Principal Investigator and I. A. Reid 1975 7 p refs Presented at 10th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 6-10 Oct. 1975 Sponsored by NASA ERTS
(E76-10209; NASA-CR-146341) Avail: NTIS HC $3.50 CSCL 17B

There are no author-identified significant results in this report.

N76-18622*# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
COLLECTION OF RELEVANT RESULTS OBTAINED WITH THE SKYLAB IMAGES BY THE INSTITUTE FOR SPACE RESEARCH, INPE Final Report
Fernando DeMendonca, Principal Investigator, Joao Botelho Machado, Antonio T. Tardin, Natalio F. Koffler, Nilton T. Higa, Hardy Jost, Renato Herz, Eric R. Stoner, Jose Carlos Maia, and Ravindra Kumar Dec. 1975 95 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10211; NASA-CR-147502; INPE-793-NTE/043) Avail: NTIS HC $5.00 CSCL 08B

There are no author-identified significant results in this report.

N76-18623*# National Academy of Sciences - National Research Council, Washington, D.C.
LAND USE PLANNING Practical Applications of Space Systems
1975 65 p refs
(Contract NSR-09-012-106)
(NASA-CR-146404; Paper-3) Avail: NTIS HC $4.50; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 08B

The organization, objectives, and accomplishments of the panel on Land Use Planning are reported. Technology developments, and projected developments are discussed along with anticipated information requirements. The issues for users, recommended remote sensing programs, and space systems are presented. It was found that remote sensing systems are useful in future land use planning. It is recommended that a change detection system for monitoring land use and critical environmental areas be developed by 1979. F.O.S.

N76-18624*# National Academy of Sciences - National Research Council, Washington, D.C.
AGRICULTURE, FOREST, AND RANGE Practical Applications of Space Systems
1975 57 p refs
(Contract NSR-09-012-106)
(NASA-CR-146405; Paper-4) Avail: NTIS HC $4.50; Space Applications Board, National Research Council, 2101 Constitution

Avenue, N. W., Washington, D. C. 20418 CSCL 02C

The findings and recommendations of the panel for developing a satellite remote-sensing global information system in the next decade are reported. User requirements were identified in five categories: (1) cultivated crops, (2) land resources, (3)water resources, (4)forest management, and (5) range management. The benefits from the applications of satellite data are discussed. F.O.S.

N76-18625*# National Academy of Sciences - National Research Council, Washington, D.C.

INLAND WATER RESOURCES Practical Applications of Space Systems

1975 87 p refs

(Contract NSR-09-012-106)

(NASA-CR-146406; Paper-5) Avail: NTIS HC $5.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 08H

The work is reported of the panel concerning the application of space technology to the improved management of the nation's inland resources. The progress since the 1967-68 study is briefly reviewed. The data needed for the management of inlet water ways, and the potential benefits of better management are discussed along with 16 proposed demonstration projects. F.O.S.

N76-18626*# National Academy of Sciences - National Research Council, Washington, D.C.

EXTRACTABLE RESOURCES Practical Applications of Space Systems

1975 32 p refs

(Contract NSR-09-012-106)

(NASA-CR-146407; Paper-6) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 08G

The use of information from space systems in the operation of extractive industries, particularly in exploration for mineral and fuel resources was reviewed. Conclusions and recommendations reported are based on the fundamental premise that survival of modern industrial society requires a continuing secure flow of resources for energy, construction and manufacturing, and for use as plant foods. Author

N76-18627*# Lockheed Electronics Co., Houston, Tex. Dept. of Life Sciences Applications.

AN INTERACTIVE METHOD FOR DIGITIZING ZONE MAPS

L. E. Giddings and Everett J. Thompson Sep. 1975 43 p

(Contract NAS9-12200)

(NASA-CR-147466; JSC-09809; LEC-6498) Avail: NTIS HC $4.00 CSCL 08B

A method is presented for digitizing maps that consist of zones, such as contour or climatic zone maps. A color-coded map is prepared by any convenient process. The map is then read into memory of an Image 100 computer by means of its table scanner, using colored filters. Zones are separated and stored in themes, using standard classification procedures. Thematic data are written on magnetic tape and these data, appropriately coded, are combined to make a digitized image on tape. Step-by-step procedures are given for digitization of crop moisture index maps with this procedure. In addition, a complete example of the digitization of a climatic zone map is given. Author

N76-18628*# Southern Illinois Univ., Carbondale.

THE HYDROLOGY OF PREHISTORIC FARMING SYSTEMS IN A CENTRAL ARIZONA ECOTONE Final Report, period ending 30 Sep. 1975

George J. Gumerman, John A. Hanson, Douglas Brew, Karl Tomoff, and Carol S. Weed Oct. 1975 270 p refs Original contains color illustrations

(Contract NAS9-14610)

(NASA-CR-144492) Avail: NTIS HC $9.00 CSCL 08H

The prehistoric land use and water management in the semi-arid Southwest was examined. Remote sensing data, geology, hydrology and biology are discussed along with an evaluation of remote sensing contributions, recommendations for applications, and proposed future remote sensing studies. F.O.S.

N76-18629*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

THEORY OF PASSIVE REMOTE SENSING WITH MICROWAVES Final Report

J. A. Kong 15 Jul. 1975 301 p refs

(Contract JPL-953524)

(NASA-CR-146315) Avail: NTIS HC $9.75 CSCL 14E

Theoretical models are described which were developed for use in the interpretation of microwave data from the earth's surface. D.M.L.

N76-18630*# Alabama Univ., University. Bureau of Engineering Research.

WATER RESOURCES PLANNING FOR RIVERS DRAINING INTO MOBILE BAY Interim Report

Samuel Ng and Gary C. April Jan. 1976 102 p refs

(Contract NAS8-29100)

(NASA-CR-144192; BER-203-112) Avail: NTIS HC $5.50 CSCL 08H

A hydrodynamic model describing water movement and tidal elevation is formulated, computed, and used to provide basic data about water quality in natural systems. The hydrodynamic model is based on two-dimensional, unsteady flow equations. The water mass is considered to be reasonably mixed such that integration (averaging) in the depth direction is a valid restriction. Convective acceleration, the Coriolis force, wind and bottom interactions are included as contributing terms in the momentum equations. The solution of the equations is applied to Mobile Bay, and used to investigate the influence that river discharge rate, wind direction and speed, and tidal condition have on water circulation and holdup within the bay. Storm surge conditions, oil spill transport, artificial island construction, dredging, and areas subject to flooding are other topics which could be investigated using the mathematical modeling approach. Author

N76-18631*# Arizona Univ., Tucson.

AN ASSESSMENT OF THE IMPACT OF WATER IMPOUNDMENT AND DIVERSION STRUCTURES ON VEGETATION IN SOUTHERN ARIZONA

Jeffery S. Conn, David A. Mount, and Robin B. Clark Dec. 1975 93 p refs

(Grant NGL-03-002-313)

(NASA-CR-146325; OALS-Bull-11) Avail: NTIS HC $5.00 CSCL 08H

High-altitude color infrared photography was used to survey existing conditions, both upstream and downstream, from nineteen diversion structures in Southern Arizona to determine their effect upon vegetation health, vigor, and cover. A diversion structure is defined as a man/made feature constructed to control storm runoff. The results are used to determine the policy for future structure design. Author

N76-18632*# Ecosystems International, Inc., Gambrills, Md.

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS

Peter A. Castruccio, Harry L. Loats, Jr., and Thomas R. Fowler Jan. 1976 27 p

(Contract NAS8-30539)

(NASA-CR-144203; ECO-76-C-2-2) Avail: NTIS HC $4.00 CSCL 08H

A hydrologic planning model is developed based on remotely sensed inputs. Data from LANDSAT 1 are used to supply the model's quantitative parameters and coefficients. The use of LANDSAT data as information input to all categories of hydrologic models requiring quantitative surface parameters for their effects functioning is also investigated. Author

N76-18633*# Ecosystems International, Inc., Gambrills, Md.

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS Final Report

Peter A. Castruccio, Harry L. Loats, Jr., and Thomas R. Fowler 11 Jan. 1976 182 p refs

(Contract NAS8-30539)

(NASA-CR-144204; ECO-76-C-2-1) Avail: NTIS HC $7.50 CSCL 08H

For abstract, see N76-18632.

N76-18634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-31 DECEMBER 1975
31 Dec. 1975 106 p
(NASA-TM-X-72959; GSFC/U-40) Avail: NTIS HC $5.50 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N76-18635*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
REMOTE SENSING APPLICATION TO LAND USE CLASSIFICATION IN A RAPIDLY CHANGING AGRICULTURAL/URBAN AREA: CITY OF VIRGINIA BEACH, VIRGINIA Ph.D. Thesis
Victor Agab Omondi Odenyo Dec. 1975 205 p refs
(Contract NAS6-2388)
(NASA-CR-141408) Avail: NTIS HC $7.75 CSCL 08B

Remote sensing data on computer-compatible tapes of LANDSAT 1 multispectral scanner imager were analyzed to generate a land use map of the City of Virginia Beach. All four bands were used in both the supervised and unsupervised approaches with the LAYSYS software system. Color IR imagery of a U-2 flight of the same area was also digitized and two sample areas were analyzed via the unsupervised approach. The relationships between the mapped land use and the soils of the area were investigated. A land use land cover map at a scale of 1:24,000 was obtained from the supervised analysis of LANDSAT 1 data. It was concluded that machine analysis of remote sensing data to produce land use maps was feasible; that the LAYSYS software system was usable for this purpose; and that the machine analysis was capable of extracting detailed information from the relatively small scale LANDSAT data in a much shorter time without compromising accuracy. Author

N76-18636*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1-31 DECEMBER 1975
31 Dec. 1975 104 p
(NASA-TM-X-72960; GFSC/N-40) Avail: NTIS HC $5.50 CSCL 05B

The Non-U.S. Standard Catalog lists Non-U.S. imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-18637# Naval Weapons Center, China Lake, Calif.
RECORDING AND PROCESSING OF THERMOVISION DATA
Barry L. Thompson Aug. 1975 13 p
(AD-A016254; NWC-TP-5778) Avail: NTIS CSCL 14/3

Improved techniques have been developed for the analog recording of AGA Thermovision data using commercially available tape recorders. Linear and nonlinear recording and reproduction of the video signal from the pre-amplifier yield a record of the instrument's output with little loss in accuracy, resolution, and dynamic range. When this raw video signal is subsequently reproduced and inserted into the Thermovision monitor, all of the processing functions in the monitor can be used for reduction and analysis of the data. A crosshair generator adapted to a Thermovision format can be used to indicate the aim point of an infrared tracker on an infrared image of the target in the same spectral band. GRA

N76-18971* Forecasting International Ltd., Arlington, Va.
ENERGY AND OTHER NON-RENEWABLE RESOURCES
In its The Future Environment 15 Jul. 1975 4 p refs (For availability see N76-18969 09-80)
CSCL 10B

N76-18973* Forecasting International Ltd., Arlington, Va.
LACK OF AGREEMENT OVER THE USE AND OWNERSHIP OF THE INTERNATIONALLY SHARED RESOURCES (SUCH AS AIR SPACE, OUTER SPACE AND THE OCEANS) LEADING TO INTERNATIONAL CONFLICT
In its The Future Environment 15 Jul. 1975 29 p refs (For availability see N76-18969 09-80)
CSCL 05K

N76-18572 Joint Publications Research Service, Arlington, Va.
PROBLEM OF RESERVOIR HYDRAULICS
G. A. Urlapov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 83-97 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 68-78 (For availability see N76-18564 09-42)

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-18638 Pennsylvania Univ., Philadelphia.
ALLOCATION MODELS FOR ENERGY PLANNING Ph.D. Thesis
Reynaldo Sanchez Mariano 1975 239 p
Avail: Univ. Microfilms Order No. 76-3196

The problem of shortages of varying time duration originating from the electrical energy sector is investigated. Two different time frameworks are used to characterize the incidence of an electricity shortage: a periodic shortage occurring only for a few hours during the day at times of peak load, and a sustained shortage which is severe enough to result in permanent reduction of supply. The periodic shortage problem is approached by using a priority-weighting method. Energy users are first classified into different industry groups. Then, by pairwise comparisons of users according to various criteria, an overall measure of importance of each industry in relation to the others, expressed on a ratio scale between 0 and 1, is derived. A linear programming model is developed to study the problem of a sustained shortage. A short-term framework is assumed and the state of technology is taken as constant. The magnitude of the shortage and constraints on the model were introduced as parameters to derive alternative allocation plans under various conditions. Dissert. Abstr.

N76-18639*+ National Aeronautics and Space Administration, Washington, D.C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 6
Oct. 1975 192 p
(NASA-SP-7043(06)) Avail: NTIS HC $4.00 CSCL 10B

This bibliography lists 505 reports, articles, and other documents introduced into the NASA scientific and technical information system from April 1, 1975 through June 30, 1975. Author

N76-18640* New Mexico Univ., Albuquerque. Tech. Application Center.
NEW MEXICO ENERGY RESEARCH RESOURCE REGISTRY. RESEARCHERS AND FACILITIES Cumulative Volume through 30 June 1975
30 Jun. 1975 550 p Sponsored in part by NASA
(NASA-CR-146330; TAC-ERR-75-800) Avail: Univ. of New Mexico, Tech. Application Center HC $20.00 CSCL 05A

Human resources and facilities in New Mexico available for

application to energy research and development are listed. Information regarding individuals with expertise in the environmental, socio-economic, legal, and management and planning areas of the energy effort is included as well as those scientists, engineers, and technicians involved directly in energy research and development. Author

N76-18641* National Aeronautics and Space Administration. Pasadena Office, Calif.
HYDROGEN-BROMINE SECONDARY BATTERY Patent
Christopher England, inventor (to NASA) (JPL) Issued 15 Jul. 1975 5 p Filed 11 Jul. 1973 Sponsored by NASA
(NASA-Case-NPO-13237-1; US-Patent-3,894,887; US-Patent-Appl-SN-378127; US-Patent-Class-136-86S; US-Patent-Class-136-83R) Avail: US Patent Office CSCL 10C

A secondary battery is described utilizing hydrogen and halogen as primary reactants. It comprises inert anode and cathode initially contacting an aqueous solution of an acid and an alkali metal bromide. The hydrogen generated during charging of the cell is stored as gas, while the bromine becomes dissolved predominantly in the lower layers of the acid electrolyte. Preferred components are phosphoric acid and lithium bromide.
Official Gazette of the U.S. Patent Office

N76-18642* National Aeronautics and Space Administration. Pasadena Office, Calif.
HYDROGEN-RICH GAS GENERATOR Patent
John Houseman, inventor (to NASA) (JPL) Issued 18 Nov. 1975 11 p Filed 26 Feb. 1973 Sponsored by NASA
(NASA-Case-NPO-13464-1; US-Patent-3,920,416; US-Patent-Appl-SN-428444; US-Patent-Class-48-95; US-Patent-Class-23-281; US-Patent-Class-48-63; US-Patent-Class-48-75; US-Patent-Class-48-116; US-Patent-Class-48-117; US-Patent-Class-123-3; US-Patent-Class-423-650) Avail: US Patent Office CSCL 10B

A process and apparatus are described for producing a hydrogen rich gas from liquid hydrocarbon and water using the partial oxidation steam reforming process.
Official Gazette of the U.S. Patent Office

N76-18643* National Aeronautics and Space Administration. Pasadena Office, Calif.
ZINC-HALIDE BATTERY WITH MOLTEN ELECTROLYTE Patent
Christopher England, inventor (to NASA) (JPL) Issued 14 Oct. 1975 6 p Filed 11 Jul. 1973 Sponsored by NASA
(NASA-Case-NPO-11961-1; US-Patent-3,912,999; US-Patent-Appl-SN-378126; US-Patent-Class-320-22; US-Patent-Class-136-6LF; US-Patent-Class-136-30; US-Patent-Class-320-21) Avail: US Patent Office CSCL 10C

An electrochemical cell is described which uses zinc and either chlorine or bromine as the primary reactants, with a molten, nonaqueous zinc halide electrolyte. During charging of the cell, growth of dendrites on the zinc electrode is controlled by operating the cell continuously or intermittently at a temperature above the melting point of zinc, thereby positively preventing such growth; or by operating at such temperature that incipient dendrites are melted by heat generated by the charging current. That current may be intermittently increased to insure such dendrite control. In a large battery of cells utilizing chlorine as the halogen, excess halogen gas developed during charging of the battery is compressed and liquefied to facilitate external storage, and a large portion of the energy required for compression is recovered upon expansion of the gas during battery discharge. Official Gazette of the U.S. Patent Office

N76-18644# Select Committee on Small Business (U. S. House).
SMALL BUSINESS AND THE ENERGY SHORTAGE, VOLUME 1
Washington GPO 1973 568 p refs Hearings before Subcomm. on Special Small Business Problems of Permanent Select Comm. on Small Business, 93d Congr., 1st Sess., 22 May; 6, 21, and 27 Jun.; 10 and 17 Jul.; 5 Jul. 1973
(GPO-99-720) Avail: Subcomm. on Special Small Business Problems

The impact on small business of the growing energy problems and the measures needed to solve this problem are examined. Factors considered include: allocations; the extent of petroleum supplies, both domestic and of foreign origin; and forecasts of future supply and demand. Emphasis is placed on ways of reducing consumption. J.M.S.

N76-18645# Select Committee on Small Business (U. S. House).
SMALL BUSINESS AND THE ENERGY SHORTAGE, VOLUME 2
Washington GPO 1974 278 p refs Hearings before Subcomm. on Special Small Business Problems of Permanent Select Comm. on Small Business, 93d Congr., 2d Sess., 9 Oct.; 15 Nov. 1973; 8 Mar. 1974
(GPO-40-890) Avail: Subcomm. on Special Small Business Problems

For abstract, see N76-18644.

N76-18646# Joint Publications Research Service, Arlington, Va.
SOVIET PAPERS PRESENTED AT THE 1975 EINDHOVEN MEETING OF THERMIONIC CONVERSION SPECIALISTS
20 Jan. 1976 94 p refs Transl. into ENGLISH of Soviet papers from Dutch conf. Conf. Held at Eindhoven, Holland, 1-3 Sep. 1975
(JPRS-66621) Avail: NTIS HC $5.00

Papers on thermionic energy conversion systems and techniques are summarized. For individual titles, see N76-18647 through N76-18653.

N76-18647 Joint Publications Research Service, Arlington, Va.
STRUCTURE AND ELECTRONIC PROPERTIES OF CHALCOGEN-ELECTROPOSITIVE METAL FILMS ON SURFACES OF REFRACTORY METALS
N. V. Vokov, D. A. Gorodetskiy, Yu. K. Guskov, A. N. Knysh, Z. N. Kononova, Yu. I. Kostikov, Yu. P.- Nelnik, V. I. Subbotin, and A. A. Yasko *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 1-11 refs Transl. into ENGLISH of Soviet papers from Dutch conf. (For availability see N76-18646 09-44)

Surface and atomic structure of binary W(110)-O-Li and Re(0001)-O-Ba were studied using the DME (expansion unknown) method; their application to emission electronics was also studied. The first of these systems was determined both by the possible practical use as well as the relatively low heat of desorption of lithium from tungsten, which suggested the expectation of desorbing this metal from the surface of the system W(110)-O without disintegrating the latter. Author

N76-18648 Joint Publications Research Service, Arlington, Va.
THERMOEMISSION TOPPING TO STEAM TURBINE CYCLE
L. Ye. Apatovskiy, R. Ya. Kucherov, B. Ya. Moyzhes, and Z. M. Nevyazhskaya *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 12-22 refs Transl. into ENGLISH of Soviet papers from Dutch conf. (For availability see N76-18646 09-44)

A variety of high temperature toppings, utilizing the high temperature achieved when chemical or nuclear fuel is burned, were suggested to increase the efficiency of thermal power stations. Special attention was given to the possibility of using the thermoemission method to convert thermal energy into electrical energy. Calculations were made of chemical fuel fired stations and the results are given as they apply to nuclear power stations. In contrast to low capacity installations, where the converter diodes are in the reactor core, for heavy-duty power engineering the modification in which the converter diodes are in the heat exchanger, between the coolant loop and the water-steam loop, appears more promising. Modifications of the calculations were selected so as to reflect not only the present level of developments in thermoemission converter (TEC), but also the potentialities for their improvement. Author

N76-18649 Joint Publications Research Service, Arlington, Va.
AUXILIARY DISCHARGE SPACE CHARGE NEUTRALIZATION EFFICIENCY AND COMPARISON OF TWO THERMIONIC DEVICES FOR CURRENT REGULATION
A. A. Baranikov, V. Z. Kaybyshev, D. V. Karetnikov, G. A. Kuzin,

Ye. N. Orlova, A. L. Trutnev, and A. A. Yurchenko *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 23-47 Transl. into ENGLISH of Soviet papers from Dutch conf. (For availability see N76-18646 09-44)

The effects of electron energy, ionization probability, gas species, pressure, energy dissipation as affected by slow electron scattering of the plasma, and atomic excitation on auxiliary discharge efficiency were examined. The possibility of using the auxiliary discharge in inert gases to regulate current is determined. Author

N76-18650 Joint Publications Research Service, Arlington, Va.
THERMOEMISSION ENERGY CONVERTER WITH IMPULSE IONIZATION
V. A. Zherebtsov *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 48-60 refs Transl. into ENGLISH of Soviet papers from Dutch conf. (For availability see N76-18646 09-44)

Several problems of operating the thermoemission energy converters with impulse ionization are reported. Emphasis was placed on the working portion of the cycle - plasma breakdown. The question of how effective ionizing impulses with different polarity are was discussed. Author

N76-18651 Joint Publications Research Service, Arlington, Va.
EFFECT OF COLLECTOR MATERIAL ON CHARACTERISTICS OF THERMOEMISSION CONVERTER
I. L. Korobova, R. Ya. Kucherov, B. Ya. Moyzhes, L. M. Tsakadze, and V. K. Tskhakaya *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 62-71 refs Transl. into ENGLISH of Soviet papers from Dutch conf. (For availability see N76-18646 09-44)

The Volt-ampere characteristics (VAC) were compared with different collectors -- monocrystals, polycrystals and alloys. The hypothesis that the change in the shape of the VAC is associated with the inhomogeneity (spottiness) of the collector in terms of work function was advanced. This hypothesis was tested with a mathematical model describing processes in the plasma diode. Although it does not have quantitative characteristics of spottiness, qualitative changes in VAC when spottiness is introduced into the calculations correlate well with experiments. Author

N76-18652 Joint Publications Research Service, Arlington, Va.
INCREASE IN SPECIFIC POWER OF TEC IN REGIME WITH SURFACE IONIZATION BY USE OF DEVELOPED CATHODE
V. I. Babinin, A. S. Mustafayev, V. I. Sitnov, and A. Ya. Ender *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 72-77 refs (For availability see N76-18646 09-44)

Procedures for increasing the specific capacities and efficiencies of TEC's in conjunction with binary fillers were investigated. In particular, a systematic study was made of the physical processes and optimization of output parameters of a Knudsen TEC with surface ionization. Relatively high electric power values were obtained for an efficiency close to the Carnot cycle. Author

N76-18653 Joint Publications Research Service, Arlington, Va.
NECK TYPE OF INVERTERS FOR DIRECT CURRENT-TO-ALTERNATING CURRENT CONVERSION
G. M. Gryaznov, V. B. Kaplan, A. M. Martsinovskiy, V. I. Serbin, and V. C. Yuryev *In its* Soviet Papers Presented at the 1975 Eindhoven Meeting of Thermionic Conversion Specialists (JPRS-66621) 20 Jan. 1976 p 78-91 refs Transl. into ENGLISH of Soviet papers from Dutch Conf. (For availability see N76-18646 09-44)

The possiblity of imporving thermoemission reactor converters by applying a tranverse magnetic field to the gap, making an auxiliary discharge, and introducing into the interelectrode gap a third controlled elect electrode grid was investigated. Author

N76-18654*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN TOMORROW: DEMANDS AND TECHNOLOGY REQUIREMENTS
Dec. 1975 244 p refs
(Contract NAS7-100)
(NASA-CR-146416; JPL-5040-1) Avail: NTIS HC $8.00 CSCL 21D

National needs for hydrogen are projected and the technologies of production, handling, and utilization are evaluated. Research and technology activities required to meet the projected needs are determined. For individual titles, see N76-18655 through N76-18668.

N76-18655* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FUTURE HYDROGEN USE
In its Hydrogen Tomorrow Dec. 1975 6 p refs (For availability see N76-18654 09-44)
CSCL 10B

The use of hydrogen is related to energy consumption because hydrogen is primarily used as a feedstock in petroleum processing and in the manufacture of ammonia, methanol, and other chemicals. National energy scenarios are selected as a basis for projecting how much hydrogen will be required for established uses and how these quantities might be affected by new energy system uses for hydrogen. Author

N76-18656* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPPLY OPTIONS
In its Hydrogen Tomorrow Dec. 1975 8 p (For availability see N76-18654 09-44)
CSCL 10B

The use of captive hydrogen (produced and consumed on site) and merchant hydrogen (externally supplied) is considered. A low-merchant-captive ratio market and a high-merchant-captive ratio market are described and compared. J.M.S.

N76-18657* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TECHNOLOGY ISSUES
In its Hydrogen Tomorrow Dec. 1975 6 p refs (For availability see N76-18654 09-44)
CSCL 10B

Factors affecting the use of hydrogen are discussed. These include: efficiency, economics, and environmental effects. Emphasis is placed on the state of development of the technologies of hydrogen production, handling, and use. The needs and deficiencies in the present technologies and the ability to meet these needs effectively are considered in detail. Author

N76-18658* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONCLUSIONS
In its Hydrogen Tomorrow Dec. 1975 3 p (For availability see N76-18654 09-44)
CSCL 10B

Conclusions are presented according to general areas of technology with some specific examples of research and technology needs identified. These conclusions provide a base for the future development of detailed program plans and identify research needs that are not being given attention or are not being supported at a sufficient level. Emphasis is placed on hydrogen production and use. Author

N76-18659* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN UTILIZATION AND ALTERNATIVES
R. Manvi, R. Caputo, and T. Fujita *In its* Hydrogen Tomorrow Dec. 1975 47 p refs (For availability see N76-18654 09-44)
CSCL 10B

The historical uses of hydrogen are described along with potential new uses which could develop as a result of the diminishing supply of conventional fossil fuels such as natural gas. A perspective view of hydrogen, both as a chemical feedstock and as a fuel, is necessary to understand its relationship to the overall national energy projections. These projections, which show energy usage in terms of use sectors, forms of energy, and sources of energy, do not specifically identify hydrogen as a component of the energy system. By superimposing the traditional roles upon the new opportunities for hydrogen on the energy projections, the role of hydrogen and future projections is developed within the context of the national energy projections. Use, supply, and other factors affecting application are interrelated and are discussed. Author

N76-18660* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN PRODUCTION
C. England, J. E. Chirivella, T. Fujita, R. E. Jeffe, D. Lawson, and R. Manvi *In its* Hydrogen Tomorrow Dec. 1975 25 p refs (For availability see N76-18654 09-44)
CSCL 10B

The state of hydrogen production technology is evaluated. Specific areas discussed include: hydrogen production fossil fuels; coal gasification processes; electrolysis of water; thermochemical production of hydrogen; production of hydrogen by solar energy; and biological production of hydrogen. Supply options are considered along with costs of hydrogen production. J.M.S.

N76-18661* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FACTORS AFFECTING THE BROADENED USE OF HYDROGEN
In its Hydrogen Tomorrow Dec. 1975 21 p refs (For availability see N76-18654 09-44)
CSCL 10B

The future role of hydrogen is considered. Specific factors discussed include: storage, transmission, and distribution problems; materials compatibility and safety; environmental and social implications of increased hydrogen usage; and the economics related to expanding hydrogen use. Author

N76-18662* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EUROPEAN ACTIVITIES IN THE HYDROGEN ENERGY FIELD
J. E. Chirivella *In its* Hydrogen Tomorrow Dec. 1975 3 p refs (For availability see N76-18654 09-44)
CSCL 10B

Research activities in the hydrogen energy field in the European community are reviewed. Countries included in the discussion are: Austria, Belgium, England, Federal Republic of Germany, and Italy. Author

N76-18663* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HYDROGEN USES
R. Manvi *In its* Hydrogen Tomorrow Dec. 1975 8 p refs (For availability see N76-18654 09-44)
CSCL 10B

Brief descriptions are given of some of the present and future uses of hydrogen. Industrial synthesis, process uses, and applications to other sectors of the national economy are also considered. Author

N76-18664* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMOCHEMICAL CYCLES
J. E. Funk (Kentucky Univ., Lexington), M. A. Soliman (Kentucky Univ., Lexington), R. H. Carty (Kentucky Univ., Lexington), W. L. Conger (Kentucky Univ., Lexington), K. E. Cox (Kentucky Univ., Lexington), and D. Lawson *In its* Hydrogen Tomorrow Dec. 1975 15 p refs (For availability see N76-18654 09-44)
CSCL 10B

The thermochemical production of hydrogen is described along with the HYDRGN computer program which attempts to rate the various thermochemical cycles. Specific thermochemical cycles discussed include: iron sulfur cycle; iron chloride cycle; and hybrid sulfuric acid cycle. J.M.S.

N76-18665* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRODUCTION COST METHODS AND DATA
R. E. Jeffe and T. Fujita *In its* Hydrogen Tomorrow Dec. 1975 10 p (For availability see N76-18654 09-44)
CSCL 10B

The general gas cost equation for utility financing is presented. Modifications and assumptions made in order to apply the cost equation to hydrogen production are described. Cost data are given for various methods of hydrogen production. The cost matrix procedure is briefly discussed. J.M.S.

N76-18666* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYOGENIC STORAGE
R. L. DeWitt *In* JPL Hydrogen Tomorrow Dec. 1975 11 p refs (For availability see N76-18654 09-44)
CSCL 10B

Types of storage techniques available are described in terms of their present as well as future potential for liquid hydrogen storage. Examples are given and areas for further technology development are defined. J.M.S.

N76-18667* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS CONSIDERATIONS
Hugh R. Gray, Howard G. Nelson (NASA. Ames Research Center), Robert E. Johnson (NASA. Lyndon B. Johnson Space Center), Bryan McPherson (NASA. Marshall Space Flight Center), Frank S. Howard (NASA. John F. Kennedy Space Center, Cocoa Beach, Fla.), and James H. Swisher (ERDA, Livermore, Calif.) *In* JPL Hydrogen Tomorrow Dec. 1975 10 p (For availability see N76-18654 09-44)
CSCL 10B

Materials problems are examined that may be encountered within a hydrogen energy system. Emphasis is placed on hydrogen embrittlement, corrosion, oxidation, and erosion. Other factors discussed include: degradation of mechanical properties of structural alloys, system reliability, and maintenance costs. Author

N76-18668* Denver Research Inst., Colo.
HYDROGEN, SOCIO-ENVIRONMENTAL IMPACT
John S. Gilmore, William E. Matthews, and Mary K. Duff *In* JPL Hydrogen Tomorrow Dec. 1975 43 p refs (For availability see N76-18654 09-44)
(Contract JPL-954155)
CSCL 10B

The concept and logic flow of a hydrogen technology assessment are described along with a specific procedure for such an assessment. The development of hydrogen technology is discussed. Factors considered in the development and use of hydrogen include: stimulus of societal needs and technological innovations; economic factors; and social and environmental effects. J.M.S.

N76-18669*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STANDARDIZED PERFORMANCE TESTS OF COLLECTORS OF SOLAR THERMAL ENERGY: REVERE FLAT-PLATE COLLECTOR WITH TWO TRANSPARENT COVERS
Dec. 1975 6 p ref
(NASA-TM-X-71854; E-8593) Avail: NTIS HC $3.50 CSCL 10A

Basic test results of a solar energy collector that were determined in a solar simulator were presented. Author

N76-18670*# Ionics, Inc., Watertown, Mass. Research Div.
ANION SELECTIVE MEMBRANE
Samuel S. Alexander, Richard R. Geoffroy, and Russell B. Hodgdon [1975] 86 p refs
(Contract NAS3-28897)
(NASA-CR-134931) Avail: NTIS HC $5.00 CSCL 10C

Experimental anion permselective membranes were prepared and tested for their suitability as cell separators in a chemical redox power storage system being developed at NASA-Lewis Research Center. The goals of long-term (1000 hr) oxidative and thermal stability at 80 C in $FeCl_3$ and $CrCl_3$ electrolytes were met by most of the weak base and strong base amino exchange groups considered in the program. Good stability is exhibited by several of the membrane substrate resins. These are 'styrene' divinylbenzene copolymer and PVC film. At least four membrane systems produce strong flexible films with electrochemical properties (resistivity, cation transfer) superior to those of the 103QZL, the most promising commercial membrane. The physical and chemical properties of the resins are listed. Author

N76-18671*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE POTENTIAL BENEFIT OF AN ADVANCED INTEGRATED UTILITY SYSTEM
Barry M. Wolfer Nov. 1975 48 p refs
(NASA-TM-X-58170; JSC-09964) Avail: NTIS HC $4.00 CSCL 10B

The applicability of an advanced integrated utility system based on 1980 technology was investigated. An example of

such a system, which provides electricity, heating and air conditioning, solid waste disposal, and water treatment in a single integrated plant, is illustrated for a hypothetical apartment complex. The system requires approximately 50 percent of the energy and approximately 55 percent of the water that would be required by a typical current conventional system. Author

N76-18672*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 100 kW EXPERIMENTAL WIND TURBINE: SIMULATION OF STARTING, OVERSPEED, AND SHUTDOWN CHARACTERISTICS
Leonard J. Gilbert [1976] 27 p refs
(NASA-TM-X-71864; E-8629) Avail: NTIS HC $4.00 CSCL 10A

The ERDA/NASA 100 kW experimental wind turbine is modeled on a digital computer in order to study the performance of a wind turbine under operating conditions. Simulation studies of starting, overspeed, and shutdown performance were made. From these studies operating procedures, precautions, and limitations are prescribed. Author

N76-18673*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOVOLTAIC TEST AND DEMONSTRATION PROJECT
A. F. Forestieri, H. W. Brandhorst, Jr., and J. N. Deyo 1976 6 p refs Presented at Intern. Conf. on Solar Elec., Toulouse, 1-5 Mar. 1976; sponsored by Centre Natl. d'Etudes Spatiales and Centre Natl. de la Rech. Sci.
(NASA-TM-X-71887; E-8666) Avail: NTIS HC $3.50 CSCL 10A

The primary objectives of the Photovoltaic Test and Demonstration Project are: (1) to determine operating characteristics for different solar cell systems and subsystems, (2) to prove, through tests and demonstrations, that solar cell systems can satisfy the requirements of potentially attractive residential, commercial, industrial, and smaller terrestrial applications, (3) to devise and implement the methodology, techniques and equipment to make accurate and reproducible measurements of solar cell and array performance, and diagnostic measurements on solar cells, modules and arrays, and (4) to determine the endurance of solar cell modules, component parts, and materials under expected environmental conditions. Author

N76-18674*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREE VIBRATIONS OF THE ERDA-NASA 100 kW WIND TURBINE
C. C. Chamis and T. L. Sullivan 1976 17 p refs Presented at Speciality Conf. on the Dyn. Response of Struct., Los Angeles, 30-31 Mar. 1976; sponsored by Am. Soc. of Civil Engr. and UCLA
(NASA-TM-X-71879; E-8634) Avail: NTIS HC $3.50 CSCL 10A

The ERDA-NASA wind turbine (windmill), which consists of a 93-foot truss tower, a bed plate that supports mechanical and electrical equipment, and two 62.5-foot long blades, was analyzed to determine its free vibrations using NASTRAN. The finite element representation of the system consisted of beam and plate elements. The free vibrations of the tower alone, the blades alone, and the complete system were determined experimentally in the field. These results were obtained by instrumenting the tower or blades with an accelerometer and impacting the components with an instrumented mass. The predicted results for natural frequencies and mode shapes were in excellent agreement with measured data. Author

N76-18675*# California Univ., Berkeley.
EVALUATION OF CONVENTIONAL POWER SYSTEMS
Kirk R. Smith, John Weyant, and John P. Holdren Jul. 1975 194 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954071)
(NASA-CR-146344; ERG-75-5) Avail: NTIS HC $7.50 CSCL 10B

The technical, economic, and environmental characteristics of (thermal, nonsolar) electric power plants are reviewed. The fuel cycle, from extraction of new fuel to final waste management, is included. Emphasis is placed on the fossil fuel and nuclear technologies. Author

N76-18676*# General Electric Co., Wilmington, Mass. Aircraft Equipment Div.
SOLID POLYMER ELECTROLYTE WATER ELECTROLYSIS SYSTEM DEVELOPMENT Final Technical Report
[1975] 169 p
(Contract NAS9-13430)
(NASA-CR-147501) Avail: NTIS HC $6.75 CSCL 10A

Solid polymer electrolyte technology used in a water electrolysis system (WES) to generate oxygen and hydrogen for manned space station applications was investigated. A four-man rated, low pressure breadboard water electrolysis system with the necessary instrumentation and controls was fabricated and tested. A six man rated, high pressure, high temperature, advanced preprototype WES was developed. This configuration included the design and development of an advanced water electrolysis module, capable of operation at 400 psig and 200 F, and a dynamic phase separator/pump in place of a passive phase separator design. Evaluation of this system demonstrated the goal of safe, unattended automated operation at high pressure and high temperature with an accumulated gas generation time of over 1000 hours. Author

N76-18677*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY ASSESSMENT OF SYSTEMS FOR DERIVING LIQUID AND GASEOUS FUELS FROM WASTE OR GROWN ORGANICS
Robert W. Graham, Thaine W. Reynolds, and Yih-Yun Hsu Washington Feb. 1976 42 p refs
(NASA-TN-D-8165; E-8463) Avail: NTIS HC $4.00 CSCL 10A

The overall feasibility of the chemical conversion of waste or grown organic matter to fuel is examined from the technical, economic, and social viewpoints. The energy contribution from a system that uses waste and grown organic feedstocks is estimated as 4 to 12 percent of our current energy consumption. Estimates of today's market prices for these fuels are included. Economic and social issues are as important as technology in determining the feasibility of such a proposal. An orderly program of development and demonstration is recommended to provide reliable data for an assessment of the viability of the proposal. Author

N76-18678*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECT PLAN HYDROGEN ENERGY SYSTEMS TECHNOLOGY. PHASE 1: HYDROGEN ENERGY SYSTEMS TECHNOLOGY STUDY
30 Oct. 1974 25 p refs Sponsored by NASA
(NASA-CR-146424; JPL-1200-194) Avail: NTIS HC $3.50 CSCL 10B

An overview of the potential need for hydrogen as a source of energy in the future was presented in order to identify and define the technology requirements for the most promising approaches to meet that need. The following study objectives were discussed: (1) determination of the future demand for hydrogen, based on current trends and anticipated new uses, (2) identification of the critical research and technology advances required to meet this need considering, to the extent possible, raw material limitations, economics, and environmental effects, and (3) definition and recommendation of the scope and space of a National Hydrogen Energy Systems Technology Program and outline of a Program Development Plan. Author

N76-18679*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A MOUNT FOR CONTINUOUSLY ORIENTING A COLLECTOR DISH IN A SYSTEM ADAPTED TO PERFORM BOTH DIURNAL AND SEASONAL SOLAR TRACKING Patent Application
Lott W. Brantley and Billy D. Lawson, inventors (to NASA) Filed 29 Jan. 1976 12 p
(NASA-Case-MFS-23267-1; US-Patent-Appl-SN-653422) Avail: NTIS HC $3.50 CSCL 13I

The mount is characterized by a rigid, angulated axle having a linear midportion supporting a collector dish, and oppositely extended end portions normally related to the midportion of the axle and received in spaced journals. The longitudinal axis of symmetry for the midportion of the axle is coincident with a

seasonal axis while the axes of the journals are coincident with a diurnal axis paralleling the earth's polar axis. Drive means are provided for periodically displacing the axle about the diurnal axis at a substantially constant rate, while other drive means are provided for periodically indexing the dish through 1 deg about the seasonal axis, once during each of the earth's successive rotations about its polar axis. The position of the dish relative to the axle is thus varied for accommodating seasonal tracking as changes in the angle of inclination of the polar axis occur.
NASA

N76-18680*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR PHOTOLYSIS OF WATER Patent Application
Porter R. Ryason, inventor (to NASA) (JPL) Filed 13 Feb. 1976 14 p
(Contract NAS7-100)
(NASA-Case-NPO-13675-1; US-Patent-Appl-SN-658132) Avail: NTIS HC $3.50 CSCL 21D

Hydrogen is produced by the solar photolysis of water in a photooxidation vessel in the presence of a water soluble photooxidizable reagent and an insoluble hydrogen recombination catalyst. Simultaneously oxygen is produced in a photoreduction reactor in the presence of an insoluble photoreduction reagent catalyst. When spent, the solution from the first reactor is fed into the second reactor. A reaction occurs in the dark in which the redox reagents are regenerated, and the regenerated photooxidation reagent solution is recycled to the first reactor. The photooxidation reagent is preferably a europium salt, and the associated hydrogen recombination catalyst is a material such as platinum supported on glass beads. The photoreduction catalyst is a bifunctional reagent catalyst including a transition metal salt such as manganese oxychloride covalently bonded to the surface of a high area support such as glass fibers, together with a hydroxyl or chlorohydroxyl decomposition catalyst of high area.
NASA

N76-18681# Joint Committee on Internal Revenue Taxation (U. S. Congress).
ANALYSIS OF ENERGY SUPPLY, CONSERVATION, AND CONVERSION Automotive
Washington GPO 1975 22 p Prepared for the Comm. on Finance, H.R. 6860 and possible alternatives, 22 Jul. 1975
(GPO-55-802) Avail: Joint Comm. on Internal Revenue Taxation

Legislation providing tax incentives designed to reduce the consumption of fuel by automobiles and other vehicles is discussed.
D.M.L.

N76-18682# Joint Committee on Internal Revenue Taxation (U. S. Congress).
ANALYSIS OF ENERGY SUPPLY, CONSERVATION, AND CONVERSION Business Use Tax, Tax Treatment of Railroads, Home Insulation, etc.
Washington GPO 1975 18 p Prepared for the Comm. on Finance, H.R. 6860 and possible alternatives, 22 Jul. 1975
(GPO-55-800) Avail: Joint Comm. on Internal Revenue Taxation

Legislation which provides tax incentives designed to encourage various methods of energy conservation is discussed. Rail transportation, space heating, air conditioning, materials recycling, and offshore drilling are among the areas affected.
D.M.L.

N76-18683# Committee on Commerce (U. S. Senate).
ENERGY LABELING AND DISCLOSURE
Washington GPO 1975 217 p refs Hearings on S. 349 before Comm. on Commerce, 94th Congr., 1st Sess., 24-25 Feb. 1975
(GPO-51-440) Avail: Comm. on Commerce

Energy conservation is considered in terms of energy costs of consumer products and systems. A system of disclosing the estimated annual operating cost for major household appliances, central air-conditioning and heating systems, and automobiles is proposed along with energy conservation measures in building codes. Specific topics discussed include: computer techniques for estimating the energy requirements of homes, office buildings, schools, and hospitals; energy labeling of household appliances; integrated utility systems for communities; efficiency of energy use in industry; energy conservation and the environment; and electric power system measurements.
J.M.S.

N76-18684# Brookhaven National Lab., Upton, N.Y.
MATERIALS PERFORMANCE IN OPERATING PWR STEAM GENERATORS
J. R. Weeks 1975 22 p refs Presented at the Intern. Conf. on Mater. for Nucl. Steam Generators, Gatlinburg, Tenn., 9 Sep. 1975 Sponsored by ERDA
(BNL-20307; Conf-750911-3) Avail: NTIS HC $4.25

Inconel-600 tubing in PWR steam generators developed leaks due to intergranular stress corrosion cracking or a general wastage attack. Corrosion was limited to those areas where limited coolant circulation and high heat flux caused impurities to concentrate. Wastage or pitting attack is associated with local concentration of sodium hydrogen phosphates, whereas stress corrosion is associated with local concentration of sodium or potassium hydroxides. Manufacturers recommend that the phosphate treatment of the secondary coolant be abandoned in favor of an all-volatile treatment. Experience in operating plants has shown, however, that removal of phosphate-rich sludge deposits is difficult, and that further wastage and/or intergranular stress corrosion may develop; the residual sodium phosphates gradually convert by reaction with corrosion product hydroxides to sodium hydroxide, which remains concentrated in limited flow areas. Improvements in circulation patterns were achieved by inserting flow baffles in some generators.
Author (NSA)

N76-18685# ICF, Inc., Washington, D.C.
DEMAND FOR COAL FOR ELECTRICITY GENERATION 1975 - 1984 Final Report
Aug. 1975 40 p
(PB-245216/7; FEA/G-75/487) Avail: NTIS HC $4.00 CSCL 10B

Data submitted by the Regional Electric Councils are compiled and related to the status of their respective Bulk Power Supply Programs to the Federal Power Commission. These data include projections of annual net generation requirements and scheduled generating capacity additions by primary fuel type through 1984 as well as detailed information on individual existing generating units including megawatt capacities and both primary and alternative fuel types.
GRA

N76-18686# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
ON MATHEMATICS IN ENERGY RESEARCH
William F. Lucas Sep. 1975 16 p refs
(Contract N00014-67-A-0077-0014; Grant NSF MPS-75-02024)
(AD-A016654; TR-273) Avail: NTIS CSCL 12/2

This report contains comments on the papers presented at the SIMS Research Applications Conference on Energy at Alta, Utah on July 7-11, 1975, plus remarks on some types of mathematical models and new methodologies which may prove useful in such research.
GRA

N76-18687# Federal Power Commission, Washington, D.C. Bureau of Natural Gas.
UNDERGROUND STORAGE OF NATURAL GAS BY INTERSTATE PIPELINE COMPANIES, CALENDAR YEAR 1974, WINTER 1974 - 1975
Oct. 1975 40 p refs
(PB-245749/7) Avail: NTIS CSCL 21D

Contents: Number of storage fields in 1974; Capacity, utilization, and certification of underground natural gas storage fields by jurisdictional pipeline companies in 1974; Estimated cost of storing gas underground in 1974; Winter 1974-1975 storage.
GRA

N76-18688# National Maritime Research Center, Kings Point, N.Y.
ALTERNATE ENERGY SOURCES FOR MARINE POWER PLANTS
Jose Femenia (Webb Inst. of Naval Architecture, Glen Cove, N. Y.) Sep. 1975 22 p refs
(COM-75-11474/4; NMRD-KP-144) Avail: NTIS HC $3.50 CSCL 21D

This report discussed the size of ship power plants and

other factors governing the suitability of different types of fuel for marine use. It then considers various alternatives to traditional fuels derived from crude petroleum. Types of fuel considered are other liquid hydrocarbon fuels, both natural and synthetic, hydrocarbon fuels in solid, liquid/solid, and gaseous forms, non-hydrocarbon fuels and solar and wind energy. GRA

N76-18689# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
PERFORMANCE EVALUATION OF A FUSED-ALKALI ELECTROLYTE, INTERNAL-REFORMING FUEL CELL Final Report
Edward J. Taborek Apr. 1975 32 p refs
(DA Proj. 1T0-61102-A-34A)
(AD-A016123; USAMERDC-2142) Avail: NTIS CSCL 10/2

A fuel cell system using a molten hydroxide electrolyte, a nickel cathode, and a reforming anode with a 67 sq cm palladium membrane was purchased and tested. The system, operating at 500C, produced about 8 watts from hydrogen, methane, and UDEX-raffinate fuels but appears to achieve significant lifetime under only a narrow range of operating conditions. Procedures for startup, operation, and shutdown were developed. GRA

N76-18690# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF CHARGING METHODS FOR NICKEL-CADMIUM BATTERIES
Otto C. Wagner and Dorothy D. Williams Sep. 1975 17 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-A016132; ECOM-4355) Avail: NTIS CSCL 10/3

Sealed nickel-cadmium batteries, each battery consisting of five 4.0 Ah D cells manufactured by General Electric Company, showed little difference in charge acceptance between the pulse and constant current d.c. charging modes in a temperature range of -20F to about +100F. Above +100F maximum charge acceptance is attained at the 2C rate for both charge modes, while at temperatures below +40F the charge rate should be as low as C/10. Charge control by a pressure switch developed by General Research Laboratories proved to be highly pressure switch developed by General Research Laboratories proved to be highly practical for the sealed D-type nickel-cadmium batteries employed in this study. Memory, a phenomenon due to the formation of alpha-type nickelic oxide in the nickel cathodes of vented nickel-cadmium batteries, can be erased by occasionally draining the battery to about O volt per cell at the C/10 rate. GRA

N76-18691# Naval Academy, Annapolis, Md.
OCEAN THERMAL ENERGY CONVERSION: A MODEL APPROACH
Thomas W. Frey 22 May 1975 88 p refs
(AD-A015954; USNA-TSPR-66) Avail: NTIS CSCL 10/2

An Ocean Thermal Energy conversion model was successfully built and it has demonstrated the feasibility of power generation from small temperature differences similar to those existing in the tropical oceans. Seventy watts of electrical power were generated at a pressure difference of .32 psi, corresponding to an 11 F internal temperature differential. The model, the proceedings and details are described in the work. GRA

N76-18692# Simulation Physics, Inc., Burlington, Mass.
STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS Interim Report, Jun. 1974 - Jun. 1975
Allen R. Kirkpatrick and John A. Minnucci Jun. 1975 44 p refs
(Contract F33615-74-C-2001; AF Proj. 3145)
(AD-A015840; AFAPL-TR-75-54) Avail: NTIS CSCL 10/2

This report describes the first sixteen months of a two and one half year program to develop a practical integral protective cover for silicon solar cells. The report discusses selection of Corning 7070 borosilicate glass as an optimum cover material and explains the mechanics of the electrostatic field-assisted bonding process used for cover application. Excellent results have been achieved for most solar cell types. Under environmental evaluations and electron and proton irradiation tests integrally covered cells exhibit performance statistically at least equal to that of cells with conventional glued covers. GRA

N76-18693# Stanford Univ., Calif. Systems Optimization Lab.
FORMULATING A PILOT MODEL FOR ENERGY IN RELATION TO THE NATIONAL ECONOMY
George B. Dantzig Apr. 1975 22 p
(Contracts N00014-75-C-0865; N00014-75-C-0267; AT(04-3)-326-PA-18; Grant NSF MPS-71-03341-A03; NR Proj. 047-143; NR Proj. 047-064)
(AD-A016184; SOL-75-10) Avail: NTIS CSCL 10/1

This dynamic linear-programming model, on a pilot scale is an attempt to describe in physical terms many of the technological interactions within and across the sectors of the economy, including a detailed energy sector. The general objective of the model is to determine, in the face of the changing energy picture, what the country can achieve in physical terms over the long term, say 30 years. Preliminary work on the pilot model indicates that it can be completed within six months and that several useful scenarios can be run during the ensuing six months. GRA

N76-18694# UOP, Inc., Des Plaines, Ill.
CARBONACEOUS CATALYSTS FOR H3PO4 Final Technical Report
L. B. Welsh, R. W. Leyerle, G. L. Hervert, and K. J. Youtsey Sep. 1975 65 p
(Contract DAAK02-75-C-0011; DA Proj. 1G7-62708-AH-67)
(AD-A016223) Avail: NTIS CSCL 10/2

Kocite (trade mark) materials have been evaluated as low cost air and/or fuel electrocatalysts in phosphoric acid electrolyte fuel cells. Kocite materials are composite structures consisting of pyropolymers chemically bonded to refractory substrates. Fuel cell electrodes were fabricated and tested as anodes or cathodes in model fuel cells with conventional Pt fuel electrodes as counter electrodes. The research efforts have been divided into two parts. First, the performance of Kocite materials as electrocatalysts has been studied. The bulk of the program has been directed toward evaluating the performance of Kocite materials as platinum catalyst supports. GRA

N76-18181* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXPERIMENT IN DYNAMIC MODELING FOR A COMPLETE SOLAR-POWERED ENERGY SYSTEM
C. L. Hamilton *In its* The Deep Space Network 15 Feb. 1976 p 137-143 refs (For availability see N76-18163 09-12)
CSCL 10A

N76-18972* Forecasting International Ltd., Arlington, Va.
FUTURE US ENERGY DEMANDS BASED UPON TRADITIONAL CONSUMPTION PATTERNS LEAD TO REQUIREMENTS WHICH SIGNIFICANTLY EXCEED DOMESTIC SUPPLY
In its The Future Environment 15 Jul. 1975 39 p refs (For availability see N76-18969 09-80)
CSCL 10B

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-18695 Florida Univ., Gainesville.
THE ECOLOGICAL AND ECONOMIC IMPACT OF DREDGE AND FILL ON TAMPA BAY, FLORIDA Ph.D. Thesis
Lance David Limoges 1975 313 p
Avail: Univ. Microfilms Order No. 76-4253

A comprehensive environmental and economic assessment was made of the physical and cultural interrelationships that are affected when an estuary (Tampa Bay) is modified by dredge and fill activities. The investigation included a historical study which examined the coastal modifications accomplished during the past eighty-five years as well as a discussion of plans for future development. The geographical, geomorphological, biological and chemical elements which comprise the physical setting were studied. Legislation, governmental agencies, and legal restrictions were considered as they pertained to the regulation of dredge and fill activities. The ecological and economic impacts of these coastal modifications were examined through a series

of case studies. These included a historical sketch of the areas studied, the environmental impact, and the beneficial effects of the works undertaken. Dissert. Abstr.

N76-18696*# National Academy of Sciences - National Research Council, Washington, D.C.
ENVIRONMENTAL QUALITY Practical Applications of Space Systems
1975 66 p refs
(Contract NSR-09-012-106)
(NASA-CR-146408; Paper-7) Avail: NTIS HC $4.50; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 13B

The potential use of space systems to help determine the current state of air, water, and land environments was examined; the effects of man's activities on these parameters were also examined. Data are limited to pollutants introduced into the major environmental media, environmental changes manifested by such pollutants, and the effectiveness of abatement and control methods. Data also cover land quality as related to land use and public health. E.H.W.

N76-18697*# Miami Univ., Coral Gables, Fla. Dept. of Mechanical Engineering.
APPLICATION OF REMOTE SENSING FOR PREDICTION AND DETECTION OF THERMAL POLLUTION, PHASE 2
T. Nejat Veziroglu and Samuel S. Lee Dec. 1975 158 p refs
(Contract NAS10-8740)
(NASA-CR-139188) Avail: NTIS HC $6.75 CSCL 13B

The development of a predictive mathematical model for thermal pollution in connection with remote sensing measurements was continued. A rigid-lid model has been developed and its application to far-field study has been completed. The velocity and temperature fields have been computed for different atmospheric conditions and for different boundary currents produced by tidal effects. In connection with the theoretical work, six experimental studies of the two sites in question (Biscayne Bay site and Hutchinson Island site) have been carried out. The temperature fields obtained during the tests at the Biscayne Bay site have been compared with the predictions of the rigid-lid model and these results are encouraging. The rigid-lid model is also being applied to near-field study. Preliminary results for a simple case have been obtained and execution of more realistic cases has been initiated. The development of a free-surface model also been initiated. The governing equations have been formulated and the computer programs have been written. Author

N76-18698*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
ENVIRONMENTAL PARAMETERS OF THE TENNESSEE RIVER IN ALABAMA. 1: THERMAL STRATIFICATION Final Report
Lorraine M. Rosing Jan. 1976 124 p refs
(Contract NAS8-30772)
(NASA-CR-144198; UAH-RR-173) Avail: NTIS HC $5.50 CSCL 13B

Thermal stratification data of a transect across Wheeler Reservoir are correlated with the climatological data at the time of sampling. This portion of the Tennessee River is used as a heat sink for the effluent from the three reactor Browns Ferry Nuclear Power Plant. The transect sampling line is 1.3 miles below this point of effluence. Data are presented by weekly samplings for one year prior to plant operations. Post-operational data are presented with one reactor in operation and with two reactors in partial operation. Data gathering was terminated when the plant ceased operations. The results indicate that the effluent for partial plant operation were inconclusive. As a result, recommendations include continuing the sampling when the plant resumes operation at full capacity. Recommendations also include developing math models with the presented thermal and climatological data to be used for predicting the effluent impact in the river with varying climatological conditions and also to predict the effectiveness of the cooling towers. Author

N76-18699*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SELECTED METHODS FOR QUANTIFICATION OF COMMUNITY EXPOSURE TO AIRCRAFT NOISE
Philip M. Edge, Jr. and Jimmy M. Cawthorn Washington Feb. 1976 57 p refs
(NASA-TN-D-7977; L-10223) Avail: NTIS HC $4.50 CSCL 13B

A review of the state-of-the-art for the quantification of community exposure to aircraft noise is presented. Physical aspects, people response considerations, and practicalities of useful application of scales of measure are included. Historical background up through the current technology is briefly presented. The developments of both single-event and multiple-event scales are covered. Selective choice is made of scales currently in the forefront of interest and recommended methodology is presented for use in computer programing to translate aircraft noise data into predictions of community noise exposure. Brief consideration is given to future programing developments and to supportive research needs. Author

N76-18700*# Federal Council for Science and Technology, Washington, D.C. Council on Environmental Quality.
FLUOROCARBONS AND THE ENVIRONMENT. REPORT OF FEDERAL TASK FORCE ON INADVERTENT MODIFICATION OF THE STRATOSPHERE
Ermine VanDerWyk, ed. (JPL) Jun. 1975 114 p refs Sponsored by NASA
(NASA-CR-146339; LC-75-600057) Avail: NTIS MF $2.25; SOD HC $1.90 CSCL 13B

Possible consequences of stratospheric ozone reduction due to fluorocarbon contamination are evaluated. The fluorocarbon industry, economic factors, and Federal roles in this area are also discussed. For individual titles, see N76-18701 through N76-18707.

N76-18701* Federal Council for Science and Technology, Washington, D.C.
EXECUTIVE SUMMARY
In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 1-6 (For availability see N76-18700 09-45)
CSCL 13B

Possible effects of fluorocarbon-initiated stratospheric ozone depletion on the stratosphere, earth climate, biological organisms, and public health are briefly reviewed. The fluorocarbon industry and governmental regulation of these compounds are discussed. Research projects concerning the subject are also mentioned. D.M.L.

N76-18702* Federal Council for Science and Technology, Washington, D.C.
CONCLUSIONS AND FEDERAL ACTIONS
In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 7-19 (For availability see N76-18700 09-45)
CSCL 13B

Findings regarding fluorocarbon production, the roles of ozone and fluorocarbons in atmospheric chemistry, the depletion of stratospheric ozone by fluorocarbons, and various effects of this depletion are outlined. Research into these areas is described and recommendations are given for governmental action to reduce the release of fluorocarbons to the environment. D.M.L.

N76-18703* Federal Council for Science and Technology, Washington, D.C.
STRATOSPHERIC EFFECTS
In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 21-51 refs (For availability see N76-18700 09-45)
CSCL 13B

The mechanism of the destruction of ozone by fluorocarbons is described and models for predicting future levels of stratospheric ozone are discussed. Measurement of various stratospheric constituents, particularly ozone, fluorocarbons, and other chlorine compounds, is also considered. Industrial and governmental activities in this area are described. D.M.L.

N76-18704*# Federal Council for Science and Technology, Washington, D.C.
BIOLOGICAL EFFECTS OF OZONE REDUCTION

In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 53-64 refs (For availability see N76-18700 09-45) CSCL 13B

The effects of increased UV radiation on the biosphere are described with ongoing research, and research areas that should be investigated. Some mention is also made of the potential climatic effects of ozone reduction on agriculture and the biosphere. Author

N76-18705* Federal Council for Science and Technology, Washington, D.C.

HUMAN HEALTH EFFECTS OF OZONE REDUCTION

In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 65-76 refs (For availability see N76-18700 09-45) CSCL 13B

Modification of the stratosphere, such as a reduction in its equilibrium ozone content, could produce direct and indirect effects on human health. The direct hazard to humans would be caused by an increase in the cumulative amount of UV radiation reaching the earth's surface in the range of 285 to 340 nm, encompassing the UV-B or erythemal wavelength region of 280 to 320 nm. Exposing the susceptible human population to an increased total UV dosage of shorter wavelengths could increase skin cancer incidence. Although effects would be delayed by decades, for each 1% decrease in ozone the expected increase in skin cancer incidence would be on the order of 2%. Author

N76-18706* Federal Council for Science and Technology, Washington, D.C.

THE FLUOROCARBON INDUSTRY

In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 77-99 refs (For availability see N76-18700 09-45) CSCL 13B

An overview of the history, production, and uses of fluorocarbons, the extent of leakage to the atmosphere, and the possibilities for developing or expanding the use of substitute products is presented. Some data are also included on the economic value and the work force related to fluorocarbon production and applications. Author

N76-18707* Federal Council for Science and Technology, Washington, D.C.

FEDERAL AUTHORITIES

In its Fluorocarbons and the Environment. Rept. of Federal Task Force on Inadvertent Modification of the Stratosphere Jun. 1975 p 101-109 refs (For availability see N76-18700 09-45) CSCL 13B

Existing Federal authority to regulate fluorocarbons and the effectiveness of the various types of regulation are considered. D.M.L.

N76-18708# Army Electronics Command, Fort Monmouth, N.J.

INSTALLATION AND OPERATION OF AN ATMOSPHERIC PARTICULATE COLLECTOR

Carmine Petracca and James D. Lindberg Sep. 1975 24 p refs

(DA Proj. 1T1-61102-B-53A)

(AD-A016163; ECOM-5575) Avail: NTIS CSCL 20/6

The Atmospheric Sciences Laboratory (ASL) at White Sands Missile Range (WSMR) NM, has an active program to measure the optical absorption coefficient of atmospheric particulate matter collected from a variety of world wide geographic locations as part of a mission objective to determine the potential adverse effects of such dust on military night vision, target designation, remote sensing, and other systems relying on propagation of light in the atmosphere. To insure that the samples collected from different localities can be directly compared, the sampling equipment and procedure must be standardized. This report describes the design details of the collector and procedure developed for this purpose. The collector uses a 47-millimeter-diameter 0.45-micrometer pore size membrane filter through which air is pulled by means of an auxiliary vacuum pump. Illustrations of operational details of the collector are included. GRA

N76-18709# Little (Arthur D.), Inc., Cambridge, Mass.

CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM FOR MULTIMODAL ACCIDENTS (CHRISMA). A REEVALUATION OF CHRIS FOR ALL MODES OF TRANSPORTATION Final Report

Donald S. Allan and George H. Harris Apr. 1975 132 p refs (Contract DOT-CG-24655-A)

(AD-A016296; ADL-C-74685-60-F; USCG-D-148-75) Avail: NTIS CSCL 13/2

This report examines the need for improved technical and other information for meeting emergencies connected with the transportation of hazardous materials, particularly actual or potential chemical discharges regardless of mode. The Chemical Hazards Response Information System (CHRIS), under development by the United States Coast Guard to furnish in-depth guidance during emergencies involving waterborne transport, was seen as a likely prototype for other modes as well. Accordingly, a reevaluation of CHRIS has been conducted to determine the desirability of enlarging its scope to encompass all modes of transportation. It is concluded that the expanded system would indeed be beneficial in reducing losses to life, property, and the environment. Necessary modifications to CHRIS are conceptually quite modest in nature. The information system would be composed of a decentralized organization providing response guidance on request to local emergency services personnel, a computerized hazard assessment system operated at Headquarters, and three reference manuals furnished to all response organizations. GRA

N76-18710# Naval Research Lab., Washington, D.C.

OPERATOR'S MANUAL FOR THE COMPACT X-RAY ANALYZER

J. V. Gilfrich 9 Sep. 1975 21 p refs

(Contract EPA-IAG-D5-0344; NRL Proj. P04-06)

(AD-A015945; NRL-MR-3131) Avail: NTIS CSCL 09/3

A low cost, compact wavelength dispersion X-ray fluorescence analyzer has been built by the Naval Research Laboratory for the Environmental Protection Agency. This report documents the recommended method of operation of this instrument and includes diagrams of the special components fabricated for it. Author (GRA)

N76-18711# National Marine Fisheries Service, Highlands, N.J.

AN ENVIRONMENTAL SURVEY OF EFFECTS OF DREDGING AND SPOIL DISPOSAL, LONDON, CONNECTICUT Quarterly Report, Apr. - Jun. 1975

15 Aug. 1975 120 p refs Prepared in cooperation with Connecticut Univ., Noank and New York Ocean Sci. Lab., Montauk Sponsored in part by Navy

(AD-A015647; MACFC-Informal-75; QR-4) Avail: NTIS CSCL 13/2

The report considers the activities and findings of the several integrated research projects designed to monitor the environmental effects of dredging in the Thames River and dredge spoil disposal at the New London Dumping Ground. Surveying of dredging impacts on suspended materials in the Thames River has been completed by UCONN. The data confirm earlier indications that effects are limited to within 150 m of the dredge. A model of the river's flow characteristics has been selected and is in the the testing phase. (Three predredging surveys were conducted to determine baseline temperature, salinity, suspended solids and light transmission characteristics of the lower Thames River. These data were also used, in conjunction with historical information, to estimate predredging circulation of the lower river.) Mercury in river water was lower in February and April 1975 than during earlier periods, perhaps due to the removal by dredging of contaminated sediments. The report indicates large decreases, apparently due to natural seasonality, in benthic macrofaunal densities throughout the study area between predisposal and April 1975 collections. Predisposal water and sediment samples from 44 stations have been analyzed for fecal coliform and other bacteria. Highest fecal coliform counts were found in the river. Coliform counts were higher at disposal area stations on an ebb than on a flood tide, indicating that the Thames River outflow can have an effect on water quality within the designated disposal area. GRA

N76-18712# CADCOM, Inc., Annapolis, Md.
APPLICATION OF US NAVY POLLUTION ABATEMENT TECHNOLOGY TO LOCAL GOVERNMENTS AND INDUSTRIES Final Report, Oct. 1974 - Mar. 1975
Rhodes R. Copithorn, Don L. Griffin, and C. O. Heller Mar. 1975 108 p refs
(Contract N00014-74-C-0058)
(AD-A016047; CADCOM-75-c) Avail: NTIS CSCL 13/2

Water pollution abatement technology within the U.S. Navy was evaluated and compared with the needs of the civilian sector, particularly municipalities, industries, and the boating community. Since the Navy technology appeared to have potential application within the civilian sector, recommendations were made as to methods for improving the transfer of the technology. One potential transfer vehicle that was utilized was a one-day workshop entitled 'Workshop on the Application of Pollution Abatement Technology to Local Governments,' held in Annapolis on October 16, 1974. The workshop was sponsored by the Naval Ship Research and Development Center. GRA

N76-18713# Coast Guard Research and Development Center, Groton, Conn.
MONITORING DISSOLVED HYDROCARBONS AS A FUNCTION OF THE TIDAL CYCLE (NEW YORK HARBOR) Final Report
William E. McGowan Apr. 1975 39 p refs
(AD-A015882; CGR/DC-4/75; USCG-D-106-75) Avail: NTIS CSCL 13/2

Measurements of dissolved hydrocarbon (C1-C4) as a function of the tidal cycle are reported. Measurements were made from 19 Sep to 5 Oct 1973 to evaluate a dissolved hydrocarbon monitoring system and to gain information about the behavior of dissolved pollutants in a tidal cycle. Sea water was pumped from 2-3 feet below the water level of New York Harbor and sprayed into a partially evacuated chamber where hydrocarbons were released as gases and subsequently transferred to a portable gas chromatograph for analysis. Generally, the monitoring system operated properly in the field with an experimental error of less than 20%. The trends of the relative data illustrate both the change in hydrocarbon concentration over the tidal cycle (as much as 6X) and the day-to-day variation of the coordinated tidal data. These data indicate that efficient and meaningful monitoring of dissolved pollutants can be accomplished best with an understanding of the tidal pattern of the pre-existing pollutants. Such background information is essential: (1) to determine a sampling window in the tidal cycle which will appropriately reflect the pollutant input relative to the pre-existing levels; (2) to interpret the extent and time frame of the increase due to the pollution incident; and (3) to interpret possible irregularities in the surveillance data obtained during the sampling window.GRA

N76-18975* Forecasting International Ltd., Arlington, Va.
POLLUTION AND CONTAMINATION OF THE DOMESTIC ENVIRONMENT LEADING TO DETRIMENTAL, LONG RUN AND POSSIBLE IRREVERSIBLE EFFECTS UPON HUMAN AND ANIMAL HEALTH AND LONGEVITY
In its The Future Environment 15 Jul. 1975 49 p refs (For availability see N76-18969 09-80)
CSCL 13B

N76-18976* Forecasting International Ltd., Arlington, Va.
CONTAMINATION, MISUSE AND ABUSE OF THE GLOBAL OCEANS LEADING TO ECOSYSTEM DAMAGE AND DESTRUCTION, HEALTH CONSEQUENCES AND INTERNATIONAL CONFLICT
In its The Future Environment 15 Jul. 1975 26 p refs (For availability see N76-18969 09-80)
CSCL 13B

N76-18977* Forecasting International Ltd., Arlington, Va.
DESTRUCTION OF THE RECREATIONAL, ASTHETIC AGRICULTURAL, WILDLIFE CONSERVATION AND PRESERVATION, AND RESIDENTIAL USES OF THE LAND AS A RESULT OF THE ABUSES OF THE MANUFACTURING, COMMERCIAL, EXTRACTIVE, CONSTRUCTION, AND TRANSPORTATION INDUSTRIES
In its The Future Environment 15 Jul. 1975 23 p refs (For availability see N76-18969 09-80)
CSCL 13B

N76-18571 Joint Publications Research Service, Arlington, Va.
SIMULATION OF URBAN ATMOSPHERIC POLLUTION FROM A SERIES OF CONTINUOUS ELEVATED SOURCES
N. S. Veltishcheva *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 62-71 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 52-58 (For availability see N76-18564 09-42)

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N76-18714 Colorado State Univ., Fort Collins.
A SPECTRAL DIAGNOSTIC STUDY OF ATMOSPHERIC KINETIC ENERGETICS Ph.D. Thesis
William Russell Burrows 1975 232 p
Avail: Univ. Microfilms Order No. 75-26403

A method was developed for calculating the local rate of change of the kinetic energy in each component of rotational and divergent wind spectra, where spherical harmonics are used as basis functions. The governing equations include the pressure gradient force, the Coriolis force, horizontal and vertical advection terms, a sphericity term, and a friction remainder term. Nonlinear horizontal transfer of kinetic energy and interactions among scales of motion which give rise to this transfer were of particular interest as this is the mechanism of large scale turbulent kinetic energy exchange. The scales of motion were separated into planetary, synoptic, and small synoptic ranges. A method was derived for calculating the six types of self- and cross-interactions which can arise under this separation. Models for calculating diabatic heating and a method for estimating latent heat release were developed. A procedure was also devised for analyzing tropical cloud fields from satellite and surface observations. Dissert. Abstr.

N76-18715 Colorado State Univ., Fort Collins.
A TEST AND COMPARISON OF RADIATIVE TRANSFER MODELS THROUGH SCATTERING ATMOSPHERES Ph.D. Thesis
Warner Kenneth Reeser, Jr. 1975 200 p
Avail: Univ. Microfilms Order No. 76-4325

The radiative transfer theory was reviewed to determine its applicability to the correction of remote sensing data monitored for atmospheric scattering effects in the solar portion of the electromagnetic spectrum. A number of approaches ranging in complexity from approximate to 'exact' solutions were selected from the literature and modified for comparison purposes using data collected during the Skylab Scarp Program. Specifically, the following models were evaluated: (1) Single scattering, (2) two stream, (3) modified two stream, (4) Eddington, (5) Turner, and (6) doubling. A comparison of the various models was performed as a function of data input, target albedo, meteorological air mass present, and wavelength. Multiple scattering models are shown to give similar results using modeled data inputs. When measured optical depth values are used the more 'exact' solutions demonstrate a significant increase in accuracy. The doubling model is shown to be the best predictor of target albedo for this study. Dissert. Abstr.

N76-18716 Southern Illinois Univ., Carbondale.
EXCITATION OF ATMOSPHERIC GASES BY ELECTRON IMPACT, NITROGEN AND NITRIC OXIDE) Ph.D. Thesis
Mahmood Imami 1975 53 p
Avail: Univ. Microfilms Order No. 76-3317

Molecular excitation by electron impact one of the major atmospheric processes was examined. Areas investigated include: production of secondary electrons in nitrogen by fast electrons and simultaneous excitation of N2 bands; electron excitation of the (0,0) second positive band of nitrogen from threshold to 1000 eV; and electron impact excitation of the gamma bands of nitric oxide. Dissert. Abstr.

N76-18717 Oklahoma Univ., Norman.
BAROTROPIC INSTABILITY IN RELATION TO THE GENERATION OF SYNOPTIC-SCALE ATMOSPHERIC VORTICES Ph.D. Thesis
Chung Yi Tseng 1975 134 p
Avail: Univ. Microfilms Order No. 76-3141

The relation between barotropic instability and the generation of synoptic-scale disturbances during the extreme tornadic outbreak of April 3-4, 1974 is studied. The general features of barotropic instability are reviewed and the effect of smoothing of a wind profile on the stability characteristics is examined. It is found that smoothing eliminates the unstable waves due to truncation errors or errors inherent in the finite difference approximation, leaving large-scale instability characteristics which have physical significance. The effect of extending the boundaries to infinity on the stability characteristics of a velocity profile is also studied. It is found that such an extension will increase the instability of the velocity profile. The stability characteristics of each wind profile at four mandatory levels during the April 3-4, 1974 tornado outbreak are computed and discussed. It is found that the atmosphere over the area of maximum tornadic activity was barotropically most unstable shortly before the tornado outbreak. This result indicates the possibility that barotropic instability may be synoptically associated with the tornado outbreak. Dissert. Abstr.

N76-18718*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
LITERATURE REVIEW OF SOME SELECTED TYPES OF RESULTS AND STATISTICAL ANALYSES OF TOTAL-OZONE DATA
Raymond H. Myers Jan. 1976 37 p refs
(Grant NsG-1182)
(NASA-CR-146285) Avail: NTIS HC $4.00 CSCL 04A

The depletion of ozone in the stratosphere is examined, and causes for the depletion are cited. Ground station and satellite measurements of ozone, which are taken on a worldwide basis, are discussed. Instruments used in ozone measurement are discussed, such as the Dobson spectrophotometer, which is credited with providing the longest and most extensive series of observations for ground based observation of stratospheric ozone. Other ground based instruments used to measure ozone are also discussed. The statistical differences of ground based measurements of ozone from these different instruments are compared to each other, and to satellite measurements. Mathematical methods (i.e., trend analysis or linear regression analysis) of analyzing the variability of ozone concentration with respect to time and lattitude are described. Various time series models which can be employed in accounting for ozone concentration variability are examined. J.R.T.

N76-18719*# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
SAM 2 BALLOON TEST (STRATOSPHERIC AEROSOL MEASUREMENT) Final Report
Theodore J. Pepin Feb. 1976 9 p
(Grant NsG-1006)
(NASA-CR-146281; APP-4) Avail: NTIS HC $3.50 CSCL 04A

As a parallel effort to the LACATE balloon experiment a small optical system was constructed to enable a balloon test of a diode filter system similar to the type planned for the Nimbus-G SAM II experiment. The system was called the SAM II Balloon Test. Results of the balloon flight are summarized. Author

N76-18720*# Stanford Univ., Calif. Inst. for Plasma Research.
THE CAUSES OF GOEMAGNETIC ACTIVITY
Leif Svalgaard Dec. 1975 49 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-74-19007)
(NASA-CR-146295; SU-IPR-646) Avail: NTIS HC $4.00 CSCL 08N

The causes of geomagnetic activity are studied both theoretically in terms of the reconnection model and empirically using the am-index and interplanetary solar wind parameters. It is found that two separate mechanisms supply energy to the magnetosphere. One mechanism depends critically on the magnitude and direction of the interplanetary magnetic field. Both depend strongly on solar wind speed. The energy input is modulated by the tilt of the dipole axis being maximum for 90 deg tilt against the solar wind flow direction. The energy input due to reconnection has no significant seasonal variations for equal amount of both sector polarities. Author

N76-18721*# Stanford Univ., Calif.
RECALIBRATION OF BARTELS GEOMAGNETIC ACTIVITY INDICES Kp AND ap TO INCLUDE UNIVERSAL TIME VARIATIONS
Leif Svalgaard Dec. 1975 26 p refs Submitted for publication
(Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-74-19007)
(NASA-CR-146317; SU-IPR-649) Avail: NTIS HC $4.00 CSCL 08N

The ap index (and derived indices) are recalibrated using Mayaud's am-index to recover the correct Universal Time variations. Such variations were artificially removed in the original ap-index. A number of tests are performed to show that the corrected index is capable of revealing the desired variations. These tests include comparisons of the UT-variations on days of opposite interplanetary magnetic sector polarity. A finding, that geomagnetic activity was considerably higher during intervals of toward polarity prior to 1963, is strongly confirmed. Author

N76-18722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAVITY ANOMALY DETECTION: APOLLO/SOYUZ
F. O. Vonbun, W. D. Kahn, J. W. Bryan, P. E. Schmid, W. T. Wells (Wolf Res. and Develop. Corp., Riverdale, Md.), and D. T. Conrad (Wolf Res. and Develop. Corp., Riverdale, Md.) 16 Mar. 1976 20 p refs Presented at conf. of Am. Geophys. Union, San Francisco, Dec. 1975 Submitted for publication
(NASA-TM-X-71069; X-920-75-308) Avail: NTIS HC $3.50 CSCL 08N

The Goddard Apollo-Soyuz Geodynamics Experiment is described. It was performed to demonstrate the feasibility of tracking and recovering high frequency components of the earth's gravity field by utilizing a synchronous orbiting tracking station such as ATS-6. Gravity anomalies of 5 MGLS or larger having wavelengths of 300 to 1000 kilometers on the earth's surface are important for geologic studies of the upper layers of the earth's crust. Short wavelength Earth's gravity anomalies were detected from space. Two prime areas of data collection were selected for the experiment: (1) the center of the African continent and (2) the Indian Ocean Depression centered at 5% north latitude and 75% east longitude. Preliminary results show that the detectability objective of the experiment was met in both areas as well as at several additional anomalous areas around the globe. Gravity anomalies of the Karakoram and Himalayan mountain ranges, ocean trenches, as well as the Diamantina Depth, can be seen. Maps outlining the anomalies discovered are shown. Author

N76-18723*# GCA Corp., Bedford, Mass. Technology Div.
AIRBORNE PHOTOGRAPHY OF CHEMICAL RELEASES AND ANALYSIS OF TWILIGHT SKY BRIGHTNESS DATA, PHASES 1 AND 2 Final Report
John F. Bedinger and Eustratios Constantinides Jan. 1976 42 p refs
(Contract NAS2-7998)
(NASA-CR-137832; GCA-TR-76-1-N) Avail: NTIS HC $4.00 CSCL 04A

The photography from aboard an aircraft of chemical releases is reported. The equipment installation on the aircraft is described, and photographs of the releases are included. An extensive analysis of twilight sky photographs is presented. F.O.S.

N76-18724# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
ELECTRIC FIELDS AND ENERGETIC PARTICLE PRECIPITATION IN AN AURORAL ARC
T. Edwards (Appleton Lab., Slough, Engl.), D. A. Bryant (Appleton Lab., Slough, Engl.), M. J. Smith (Appleton Lab., Slough, Engl.),

U. Fahleson (European Space Technol. Center, Noordwijk, Netherlands), C-G. Faelthammar, and A. Pedersen Aug. 1975 13 p refs Presented at Summer Advanced Study School on Magnetospheric particles and Fields, Graz, 4-15 Aug. 1975
(TRITA-EPP-75-26) Avail: NTIS HC $3.50

Preliminary results were presented from a rocket flight across a single discrete auroral arc extending from early evening to magnetic midnight. The rocket was fired at the end of the growth phase of an isolated auroral substorm. It carried a separating payload to make simultaneous measurements of electrons (0.6 - 25 keV, pitch angle 0 - 60 deg) at two points, ions (same energy range) as well as of the electric field vector and plasma parameters. The electron spectra were hardest towards the center of the arc, where the peak intensity was at 9.5 keV. The electric field was northward south of the arc, southward within the arc and somewhat north of it, then again northward. The field strength reached a maximum of about 50 mV/m some distance north of the arc. An electric potential distribution, consistent with the results obtained, is presented. Author

N76-18725*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY OF A SECTOR SPECTROPHOTOMETER AND AURORAL O+(2P-2D) EMISSIONS
Gary R. Swenson Washington Jan. 1976 191 p refs
(NASA-TN-D-8143) Avail: NTIS HC $7.50 CSCL 04A

The metastable O+(2P-2D) auroral emission was investigated. The neighboring OH contaminants and low intensity levels of the emission itself necessitated the evolution of an instrument capable of separating the emission from the contaminants and having a high sensitivity in the wavelength region of interest. A new type of scanning photometer was developed and its properties are discussed. The theoretical aspects of auroral electron interaction with atomic oxygen and the resultant O+(2P-2D) emissions were examined in conjunction with N2(+)1NEG emissions. Ground based measurements of O+(2P-2D) auroral emission intensities were made using the spatial scanning photometer (sector spectrophotometer). Simultaneous measurements of N2(+)1NEG sub 1,0 emission intensity were made in the same field of view using a tilting photometer. Time histories of the ratio of these two emissions made in the magnetic zenith during auroral breakup periods are given. Theories of I sub 7319/I sub 4278 of previous investigators were presented. A rocket measurement of N2(+)1NEG sub 0,0 and O+(2P-2D) emission in aurora was examined in detail and was found to agree with the ground based measurements. Theoretical examination resulted in the deduction of the electron impact efficiency generating O+(2P) and also suggests a large source of O+(2P) at low altitude. A possible source is charge exchange of N+(1S) with OI(3P). Author

N76-18726# Naval Research Lab., Washington, D.C.
TRANSPORT TECHNIQUES FOR DESCRIBING SCATTERING AND ENERGY DEPOSITION OF ENERGETIC AURORAL ELECTRONS Interim Report
D. J. Strickland, D. L. Book, T. P. Coffey, and J. A. Fedder Sep. 1975 45 p refs
(AD-A016584; NRL-MR-3117) Avail: NTIS CSCL 04/1

Auroral electron scattering and energy loss are calculated using for the first time a multi-angle equation of transfer at all energies. The results are compared with those obtained using a Fokker-Planck equation. Both equations have been solved in terms of their eigensolutions. The equation of transfer has also been solved by numerical integration. Fokker-Planck solutions agree well with equation-of-transfer solutions above 3 keV but deviate increasingly at lower energies. A comparison is made between the present Fokker-Planck results and those of M. Walt at 10 keV, giving good agreement. Energy deposition rates are also found to agree satisfactorily with those obtained previously. The accuracy of integration of the transfer equation is tested by comparing results obtained by the eigenvalue method and the direct integration method. Differences of less than 5% were found at all altitudes, energies and pitch angles. The predicted backscatter near the upper energy boundary: is sensitive to the boundary condition there. Backscatter results for various boundary conditions in energy show both this and the effects of the propagation of the boundary condition toward lower energies. Solutions to the equation of transfer are presented over the energy range from 10 eV to 40 keV and demonstrate the rapid rise in the flux below 100 eV, which is known to occur because of secondary electron production. GRA

N76-18727# Naval Research Lab., Washington, D.C.
LINEAR MODELS OF MESOSPHERIC CIRCULATION Interim Report
Louis Baker and Darrell Strobel Aug. 1975 34 p refs
(NRL Proj. H02-36)
(AD-A016585; NRL-MR-3101) Avail: NTIS CSCL 04/1

Leovy's (1964) linear separable models are generalized to include viscosity and Rayleigh friction simultaneously and to allow the variation of static stability, heat input, and thermal relaxation arbitrarily with height. The most important parameter in the model is the Newtonian cooling rate (thermal relaxation rate). For the values given by Dickinson (1973), realistic models that describe the observed temperature and zonal wind fields are obtained. The approximations of quasi-geostrophy and linearization are valid for the momentum balance of the flow. However, near the poles and above the height of maximum forcing, vertical and horizontal heat advection is important in the energy balance. GRA

N76-18728# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
A SYNOPTIC STUDY OF THE VARIABILITY OF MESOSPHERIC IONIZATION IN WINTER Final Report, 1 Jul. 1972 - 30 Sep. 1974
Leslie C. Hale 1 Sep. 1975 14 p refs
(Grant DA-ARO(D)-31-124-72-G158; DAHC04-74-G-0096)
(AD-A016179; PSU-IRL-FR-75-1; ARO-10287.9-EN; ARO-12400.1-GS) Avail: NTIS CSCL 04/1

The research summarized includes a statistical study of the variability of mesospheric ionization in winter, three large stratospheric balloon flights, and a series of winter D-region rocket measurements. Also discussed is a Gerdien condenser measurement which showed widely separated mobility groups of mesospheric ions in the daytime. An explanation of the observed mesospheric ionization variability which involves sub-micron ice particulates has been published. GRA

N76-18729# Stanford Research Inst., Menlo Park, Calif.
EFFECTIVE RECOMBINATION COEFFICIENT OF THE POLAR D-REGION UNDER CONDITIONS OF INTENSE IONIZING RADIATION Topical Report, Nov. 1973 - Oct. 1974
Theodore M. Watt 15 Jul. 1975 105 p refs
(Contract DNA001-74-C-0167; SRI Proj. 3118; DNA Proj. NWED-AAXHX631-10)
(AD-A016675; DNA-3663T) Avail: NTIS CSCL 04/1

The intense solar-particle event in August 1972 produced high levels of ionization at altitudes of 60 to 90 km over the DNA/SRI Incoherent Scatter radar located at Chatanika, Alaska. The magnitude of the instantaneous ionizing fluxes at times approached those expected from the beta flux densities following some high-altitude nuclear detonations of interest in system problems. The cumulative radiation doses, leading to build-up of unusual molecules, were probably comparable to those expected from some high-altitude nuclear detonations. These ionizing fluxes were measured by the Lockheed 1971-089 polar-orbiting satellite. GRA

N76-18730# Utah State Univ., Logan. Electro-Dynamics Lab.
NEAR-INFRARED AURORAL SPECTRA
Doran Baker, Allan Steed, Ronald Huppi, and William Pendleton, Jr. 31 Dec. 1974 40 p refs
(Contract F19628-73-C-0048; DNA Proj. NWET-K11-BAXH)
(AD-A016755; SR-1; AFCRL-TR-75-0010) Avail: NTIS CSCL 04/1

The near-infrared spectrum of an aurora in comparison with the high-latitude night airglow has been obtained using a wide-field interferometer-spectrometer. The spectral coverage is from about 0.9 to 1.6 micrometers at a resolving power of 1600. The principal auroral features which were observed during a Class III auroral breakup the night of April 19, 1974, at Poker Flat, Alaska, are the N2(+) Meinel bands, the N2 First Positive

bands, and certain atomic O and N emission lines. Comparisons are made with laboratory spectra. GRA

N76-18731# Utah State Univ., Logan. Center for Research in Aeronomy.
STUDIES OF DISTURBED IONOSPHERES Final Scientific Report, 1 Apr. 1972 - 1 Apr. 1975
Kay D. Baker Jun. 1975 66 p refs
(Contract F19628-72-C-0255; DNA Proj. NWED-AAXHX632)
(AD-A015797; AFCRL-TR-75-0342) Avail: NTIS CSCL 04/1

Research was directed toward the investigation of disturbed ionospheres. The research primarily used rocketborne payloads instrumented to measure such ionospheric parameters as energetic particle fluxes, atmospheric emissions (ultraviolet, visible, and infrared), particle densities and composition. In many instances the rocketborne, in-situ measurements were supplemented by remote measurements from ground based instruments. Emphasis during the contractual period has been on development of both instrumentation and techniques for accomplishing the measurements as well as on obtaining the accumulated measurements themselves. Multiple programs during the 3-year period have allowed for the investigation of diverse phenomena, including PCA (polar cap absorption), AZA (Auroral Zone Absorption), auroral phenomena, and Polar Airglow. Additionally a laboratory testing program provided the initial oportunity to examine the capabilities of instruments for measuring particle densities within the confines of a controlled laboratory environment. GRA

N76-18732# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE SPATIAL RELATIONSHIP BETWEEN THE EVENING RADAR AURORA AND FIELD-ALIGHNED CURRENTS Interim Report
R. T. Tsunoda, R. I. Presnell, and T. A. Potemra Aug. 1975 44 p refs Prepared in cooperation with Stanford Research Inst., Menlo Park, Calif.
(Grant NSF DES-73-00593; NR Proj. 323-013)
(AD-A016177) Avail: NTIS CSCL 04/1

The spatial relationship of the radar aurora to the field-aligned currents observed by virtue of the transverse magnetic disturbances detected by the TRIAD satellite are examined. Using a 398-MHz phased-array radar located at Homer, Alaska, event-by-event comparisons were made between the evening radar aurora and the field-aligned currents in the 1700-to-2100 MLT sector. GRA

N76-18733# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE AMPLITUDE DISTRIBUTION OF FIELD-ALIGNED CURRENTS AT NORTHERN HIGH LATITUDES OBSERVED BY TRIAD Interim Report
Takesi Iijima and Thomas A. Potemra Aug. 1975 37 p refs Sponsored by ONR
(NR Proj. 323-013)
(AD-A016175) Avail: NTIS CSCL 04/1

The spatial distribution and magnitudes of field-aligned currents at 800 km altitude over northern high latitudes were determined from TRIAD magnetometer data recorded at College, Alaska, during the period from July 1973 to October 1974. GRA

N76-18734# Environmental Research and Technology, Inc., Concord, Mass.
THE ESTIMATION OF CLEAR SKY EMISSION VALUES FROM CLOUDY RADIOMETRIC DATA Final Report, Sep. 1974 - Jun. 1975
Mary Grace Fowler, Nien Dak Sze, Norman E. Gaut, and David T. Chang Aug. 1975 58 p refs
(Contract F19628-75-C-0035; AF Proj. 8682)
(AD-A016765; ERT-P-1234F; AFCRL-TR-75-0440) Avail: NTIS CSCL 04/1

This report determines the effects of clouds on sidelooking microwave radiometers and develops a technique to adjust cloudy emission values to equivalent clear emission measurements. Clouds of varying liquid water contents and altitudes were used with atmospheres representative of the arctic, mid-latitudes, and tropics. Their effects on microwave brightness temperatures were examined for frequencies between 15 and 55 GHz on a ground-based radiometer viewing at zenith angles from 0 degrees to 89 degrees. The strongest cloud effects were found for low elevation angles at frequencies away from the water vapor and oxygen lines. A technique is proposed which uses cloudy emission measurements made by a scanning two-channel radiometer, and a statistical inversion procedure, to infer equivalent clear emission values. GRA

N76-18735# GCA Corp., Bedford, Mass. Technology Div.
LASER BACKSCATTER EXPERIMENT Final Report, 1 Sep. 1974 - 30 Jun. 1975
Andrew Tomlinson Aug. 1975 40 p Sponsored by AF (AF Proj. 6690)
(AD-A016767; GCA-TR-75-3-A; AFCRL-TR-75-0444) Avail: NTIS CSCL 04/1

A previously fabricated payload designed to measure total atmospheric density by Rayleigh Backscatter of a Dye Laser in the thermosphere over the altitude range of 90 km to 160 km was launched from White Sands Missile Range on June 10, 1975. No data regarding density was received, however successful operation of the laser throughout the altitude range of interest was recorded. Lack of data has been determined to be due to improper synchronization of laser output with receiver gate time. GRA

N76-18736# Lockheed Missiles and Space Co., Palo Alto, Calif.
IONOSPHERIC EFFECTS INDUCED BY PRECIPITATING AURORAL ELECTRONS. HAES REPORT NO. 14 Final Report, 1 Feb. 1974 - 1 Feb. 1975
J. B. Cladis, G. T. Davidson, W. E. Francis, L. L. Newkirk, and M. Walt 22 Jul. 1975 46 p refs
(Contract DNA001-74-C-0146; DNA Proj. NWET-L25AAXY)
(AD-A016673; DNA-3648F) Avail: NTIS CSCL 04/1

The results of a coordinated experiment conducted in the auroral zone on 8 December 1971 were used to determine whether the AURORA computer code includes all of the important processes associated with the precipitation of electrons in the atmosphere. A precipitating electron flux was measured with the 1971-089A satellite simultaneously with ionospheric electron number-density distribution measurements using the Chatanika incoherent-scatter radar. The electron density distribution was compared with the distribution computed by the AURORA code, using the measured electron flux as input. The AURORA code was used to compute energy-deposition profiles in the atmosphere due to the precipitation of electrons released by high-altitude nuclear detonations. GRA

N76-18737# Lincoln Lab., Mass. Inst. of Tech., Lexington.
WORLDWIDE DETECTION CAPABILITY OF A PROTOTYPE NETWORK OF SEISMOGRAPH STATIONS
Russell E. Needham 19 Aug. 1975 38 p refs
(Contract F19628-76-C-0002; ARPA Order 512)
(AD-A016058; ESD-TR-75-250) Avail: NTIS CSCL 17/10

The detection capability of a prototype seismic network was investigated. The effect of careful reading of seismograms was determined and event lists were compared. A simple statistical model was programmed to predict the probability of an N-station detection from an M-station network with a known average station probability. GRA

N76-18738# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
Q FOR 20-SECOND RAYLEIGH WAVES FROM COMPLETE GREAT CIRCLE PATHS
D. H. VonSeggern 27 Feb. 1975 32 p refs
(Contract F08606-74-C-00066; ARPA Order 1620)
(AD-A015651; SDAC-TR-75-3) Avail: NTIS CSCL 17/10

Seismograms of carefully selected large earthquakes recorded on the high-gain, long-period network were used to visually determine the amplitude ratio of 20-second Rayleigh waves in the R sub 1 and R sub 3 phases. Identification of R sub 3 was aided by applying a time-varying processor which discriminates heavily against ground motion other than the R sub 3 signal. Ratios were determined in 29 cases representing diverse great circles over the earth; and the average Q estimated for the 20-second, fundamental-mode Rayleigh waves was 498. This value is relevant to distance-amplitude corrections routinely made in M sub s calculations and is significantly greater than that Q

implied by the current (1.66.) log delta relation. Our data did not reveal any significant difference in attenuation over oceanic and continental structures for 20-second Rayleigh waves. GRA

N76-18739# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
CHARACTER OF VERTICAL-COMPONENT SIGNALS AT HIGH-GAIN, LONG-PERIOD STATIONS AND SIGNAL INTERFERENCE ON SEISMIC DETECTION NETWORKS
D. H. VonSeggern and M. F. Tillman 27 Jul. 1975 88 p refs
(Contract F08606-74-C-0006; ARPA Order 1620)
(AD-A015969; SDAC-TR-75-1) Avail: NTIS CSCL 17/10

The amplitude and period of over 600 long-period vertical-component seismic signals were measured at regular intervals in order to characterize the LR signal and its coda. Signal envelopes out to 20 minutes after LR onset were found to vary considerably, but coda amplitudes decayed rather uniformly with time. Using average signal and coda parameters and randomly-generated events, a program which simulates long-period signal interference at seismic stations was devised to predict interference effects on network detection statistics. Increasing the size of a network should not increase the number of reported events with interference at any M sub s, but lowering the station thresholds will increase this number at lower M sub s values. GRA

N76-18740# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MIDLATITUDE E-REGION: AN EXAMINATION OF THE EXISTENCE OF A CORPUSCULAR SOURCE
Fred A. Morse and Carl J. Rice 26 Aug. 1975 54 p refs
(Contract F04701-75-C-0076)
(AD-A016061; SAMSO-TR-75-221) Avail: NTIS CSCL 04/1

This report presents data obtained from two rocket flights launched from White Sands Missile Range to investigate energetic electrons and positive ions in the E-region ionosphere below 120 km. The rocket payload was designed to measure these particles in the energy range 40 eV to 5.5 keV. The purpose of the flights was to investigate the possible role of corpuscular radiation in ionospheric E-region processes and as a source of heating in the lower thermosphere at a mid-latitude location. GRA

N76-18741# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 52
Jul. 1975 26 p refs
(Contract DNA001-74-C-0014)
(AD-A015923) Avail: NTIS CSCL 04/1

Summaries of research on atmospheric chemistry and physics are presented. Reaction kinetics, atomic and molecular physical processes, and thermochemistry related to the upper atmosphere are included. GRA

N76-18742# Naval Research Lab., Washington, D.C. Plasma Applications Branch.
COUPLED BARIUM CLOUD-IONOSPHERE SYSTEMS. 4: STRIATION PENETRATION INTO AN INHOMOGENEOUS IONOSPHERE
S. R. Goldman (Sci. Appl., Inc., McLean, Va.), A. J. Scannapieco (Sci. Appl., Inc., McLean, Va.), L. Baker, and S. L. Ossakow Jul. 1975 81 p refs
(DNA Proj. NWED-QAXH-C041)
(AD-A015618; NRL-MR-3083) Avail: NTIS CSCL 04/1

The present study investigates, via linear theory, how striations (treated as perturbations) created in a plasma cloud, centered at 200 km, will penetrate into the background inhomogeneous (real) ionosphere as a function of wavelength, integrated Pedersen conductivity ratio of the cloud to ionosphere, and ambient ionospheric conditions. The study is posed as an eigenvalue problem which while determining the potential variaton (eigenmode) along magnetic field lines, self-consistently solves for the growth rate (eigenvalue) in the coupled cloud-inhomogeneous ionospheric system. GRA

N76-18743# Northeastern Univ., Boston, Mass. Dept. of Mechanical and Electrical Engineering.
NUCLEAR BURST INDUCED SHOCK WAVE MODELING OF ENERGETIC ELECTRON INJECTION INTO THE MAGNETOSPHERE: APPLICATION OF STREAMING PLASMA INSTABILITIES TO SHOCK STRUCTURES Scientific Report, 1 Jul. 1974 - 30 Jun. 1976
John W. Cipolla, Kenneth I. Golden, and Michael B. Silevitch 15 Jul. 1975 36 p refs
(Contract F19628-75-C-0012; AF Proj. 8600)
(AD-A015858; AFCRL-TR-75-0405; SR-1) Avail: NTIS CSCL 04/1

A parallel shock wave structure is modeled as a region of interpenetrating streams of cold unshocked and hot shocked ions. The linear dispersion theory predicts that unstable whistlers can stand and therefore grow to large amplitude at the leading edge of weak and intermediate strength shocks. Magnetosonic instabilities and their role in the structure of perpendicular shock waves were also studied. Since these instabilities are not stationary in the shock layer, they cannot play a principal role in the structure. GRA

N76-18744# Panametrics, Inc., Waltham, Mass.
AN ELECTROSTATIC ANALYZER FOR AN AIR FORCE SATELLITE PAYLOAD
Frederick A. Hanser and Bach Sellers Jul. 1975 13 p refs
(Contract F19628-73-C-0019; AF Proj. 7601)
(AD-A015798; AFCRL-TR-75-0366; SR-2) Avail: NTIS CSCL 04/1

A satellite-borne electron spectrum analyzer has been developed. This instrument performs a 32 channel differential analysis of 0.08 to 17 keV electrons, via electrostatic deflection. The described instrument is a modified version of units successfully launched into auroral breakups at Ft. Churchill, Manitoba, Canada. The modified design minimizes weight and power requirements, and provides an interface compatible with certain Air Force small satellites. Two instruments have been fabricated, tested and calibrated. One has been integrated into an Air Force Small satellite, scheduled for launch in 1975. The second instrument undergoes periodic checks and is maintained as a backup unit to the flight unit. GRA

N76-18978* Forecasting International Ltd., Arlington, Va.
DETERIORATION AND MODIFICATION OF THE BIOSPHERE LEADING TO IRREVERSIBLE CLIMATIC CHANGE OF THE GLOBAL ECOSYSTEM
In its The Future Environment 15 Jul. 1975 25 p refs (For availability see N76-18969 09-80)
CSCL 04A

N76-18566 Joint Publications Research Service, Arlington, Va.
DAMPING OF THE GRAVITY WAVES IN THE ATMOSPHERE UNDER THE EFFECT OF THE PLANETARY BOUNDARY LAYER
V. M. Kadyshnikov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 15-23 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 14-20 (For availability see N76-18564 09-42)

N76-18568 Joint Publications Research Service, Arlington, Va.
LOW-LATITUDE TROPOSPHERIC CIRCULATION MODEL
L. Kh. Ingel *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 38-46 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 31-38 (For availability see N76-18564 09-42)

N76-18574 Joint Publications Research Service, Arlington, Va.
CALCULATING THE SOIL TEMPERATURE FOR THE COLD SEASON
E. G. Palagin and L. N. Gutman *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 116-129 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 92-101 (For availability see N76-18564 09-42)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-18745 Oklahoma Univ., Norman.
STOCHASTIC GENERATION OF HYDROLOGIC MODEL INPUTS Ph.D. Thesis
Arlin Dwight Nicks 1975 150 p
Avail: Univ. Microfilms Order No. 76-3120

Stochastic generation models were developed to synthesize the daily rainfall and meteorological data that can be used as input to existing hydrologic models for simulation of runoff from watersheds. Synthetic rainfall records were generated at 168 locations of an existing rain gage network covering a 1,500-square-mile area of central Oklahoma. Models were also developed to stochastically generate the maximum and minimum daily temperature, mean daily temperature, and solar radiation for the area. These synthetic data were also tested against observed daily records and the representativeness of the synthetic data determined. A Markov chain model for generating wet day-dry day sequence for the network area was highly satisfactory as was the method of generating mean rainfall for the area. Results of tests made on the data generated by the rainfall model show that 71 percent of the synthetic records at 168 stations would be accepted as being from the same population of observed data. Dissert. Abstr.

N76-18746 Florida State Univ., Tallahassee.
ON NUMERICAL PREDICTION OVER A GLOBAL TROPICAL BELT Ph.D. Thesis
Masao Kanamitsu 1975 309 p
Avail: Univ. Microfilms Order No. 76-2655

Major improvements were made in Florida State University's Tropical Prediction Model for the purpose of applying the model to medium range prediction over a global tropical belt. The revisions include the formulation of a new finite differencing scheme which prevents spurious gravity wave development; use of relative humidity for the moisture prediction equation to more accurately evaluate the latent heating; and the application of an iterative initialization procedure for tropical latitudes using the multilevel primitive equation model. The new version of the primitive equation prediction model includes various complex physical processes: long wave radiation, short wave radiation and its diurnal variation, convective heating, large scale condensation, boundary layer processes, a surface energy balance to evaluate the ground temperature and moisture, and the effects of topography. The physical processes, finite difference schemes and initialization are discussed in detail with relevant results presented for a number of experiments. Dissert. Abstr.

N76-18747 California Univ., Los Angeles.
THE EFFECT OF ELECTRIC CHARGES AND FIELDS ON THE COLLECTION EFFICIENCY OF CLOUD DROPS Ph.D. Thesis
Elena Sara Lobl 1975 95 p
Avail: Univ. Microfilms Order No. 76-3062

Cloud drops in the range 20 micron (CH76) or = A (CH76) 80 micron and p-ratios between 0.19 and 0.50 were studied. Collision and coalescence efficiencies indicate that rebound is possible; coalescence efficiency is not necessarily unity. The addition of electric charges and fields in the collection process is discussed. The existence of a threshold charge for the onset of a unity coalescence efficiency and affected collision regions is suggested, and cloud tunnel results corroborate this hypothesis. Graphs of collection efficiency versus charge show a linear increase to a threshold charge. Coalescence efficiencies less than unity for small charges on the drops do not explain the rapid collection process needed for the initiation of warm rain. Other effects present in a cloud with drops in the size range studied probably offset the effects found. The obtained collection efficiencies and the leakage of charge should be included in proposed charge separation mechanisms. Dissert. Abstr.

N76-18748 Wisconsin Univ., Madison.
THE ROLE OF ADIABATIC AND DIABATIC PROCESSES IN THE MASS BUDGET OF EXTRATROPICAL CYCLONES Ph.D. Thesis
Ralph Alvin Petersen 1975 186 p
Avail: Univ. Microfilms Order No. 75-20787

A technique is presented whereby studies of mass redistribution and stability change can be made relative to a moving budget volume positioned about an extratropical cyclone center. Isentropic coordinates are employed to allow separation of the roles of adiabatic and diabatic processes in the mass redistribution during cyclone development. Moist cyclones exhibit a well organized pattern of low level mass inflow-upper level mass outflow linked by diabatic mass transport. The dry, storm, develops under a situation of upper level mass inflow-lower level mass outflow, and is accompanied by adiabatic vertical stretching throughout much of the troposphere. Once this cyclone is well developed and a moisture supply becomes available, it takes on characteristics similar to those of the three moist cyclones. The maximization of the diabatic mass transport in the area of these cyclones' exit regions plays a key role in the maintenance of the cyclone. Dissert. Abstr.

N76-18749*# National Academy of Sciences - National Research Council, Washington, D.C.
WEATHER AND CLIMATE Practical Applications of Space Systems
1975 35 p refs
(Contract NSR-09-012-106)
(NASA-CR-146402; Paper-1) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 04B

Recommendations for using space observations of weather and climate to aid in solving earth based problems are given. Special attention was given to: (1) extending useful forecasting capability of space systems, (2) reducing social, economic, and human losses caused by weather, (3) development of space system capability to manage and control air pollutant concentrations, and (4) establish mechanisms for the national examination of deliberate and inadvertent means for modifying weather and climate. E.H.W.

N76-18750*# Stanford Univ., Calif. Inst. for Plasma Research.
SOLAR STRUCTURE AND TERRESTRIAL WEATHER
John M. Wilcox Jan. 1976 18 p refs Submitted for publication
(Contract NGR-05-020-559; Contract N00014-76-C-0207; Grants NSF ATM-74-19007; NSF DES-75-15664)
(NASA-CR-146306; SU-IPR-652) Avail: NTIS HC $3.50 CSCL 04B

The possibility that solar activity has discernible effects on terrestrial weather is considered. Research involving correlation of weather conditions with solar and geomagnetic activity is discussed. D.M.L.

N76-18751# Battelle Pacific Northwest Labs., Richland, Wash. Atmospheric Sciences Dept.
WIND AND TURBULENCE INFORMATION FOR VERTICAL AND SHORT TAKE-OFF AND LANDING (V/STOL) OPERATIONS IN BUILT-UP URBAN AREAS: RESULTS OF METEOROLOGICAL SURVEY Final Report
J. V. Ramsdell Jun. 1975 421 p refs
(Contract DOT-FA72WAI-263)
(AD-A019216/1; FAA-RD-75-94) Avail: NTIS HC $11.00 CSCL 01/5

Winds and turbulence were measured at urban STOL and VTOL port sites and at a conventional rural airport. These measurements were used to develop a set of turbulence models for use in: design of V/STOL aircraft stability and control features; development of airworthiness criteria for certification of V/STOL aircraft; and simulation of the turbulence in the urban terminal environment of V/STOL aircraft. The model set includes spectral models, rms gust velocity models, and turbulence length scale models. Probability distributions are given for gust velocities and length scales. The data and the models are compared with conventional, flat-terrain turbulence models and data. Other topics discussed include: atmospheric boundary layer theory; the measurement sites, instrumentation, and data processing; spatial aspects of turbulence; and the standard airport cup anemometer. Author

N76-18752# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
LIGHTNING SOURCES IN SEVERE THUNDERSTORMS
A. A. Few 22 Sep. 1975 8 p refs Repr. from Conf. on Cloud Phys., Am. Meteoro. Soc., 1974

(Contracts N00014-75-C-0139; N00014-67-A-0145-0004; NR Proj. 211-191)
(AD-A016839; TR071-754) Avail: NTIS CSCL 04/1

Acoustic techniques are employed to determine the location of all of the lightning activity during the life cycle of a severe thunderstorm. These results have been compared in time and space to radar echo contours, and it has been found that (1) the lightning activity is layered near -10 degrees C, (2) the active region and many channels are predominantly horizontal, (3) the horizontal channels exhibit alignment, (4) lightning activity is concentrated in regions of low radar reflectivity, and (5) radar reflectivity enhancement occurs locally following lightning activity. GRA

N76-18753# Saint Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
RESEARCH TO DEVELOP IMPROVED MODELS OF CLIMATOLOGY THAT WILL ASSIST THE METEOROLOGIST IN THE TIMELY OPERATION OF THE AIR FORCE WEATHER DETACHMENTS
Donald E. Martin 30 Jun. 1975 108 p refs
(Contract F19628-74-C-0004)
(AD-A016850; SR-1; AFCRL-TR-75-0447) Avail: NTIS CSCL 04/2

This report considers the devising of climatic presentations for usage in preparing 2- and 4-hour forecasts of low ceilings and restricted visibilities. A hierarchy of empirical relationships for estimating the recurrence probabilities are made possible through the use of statistical modelling and analysis techniques which act to conserve the data base. GRA

N76-18754# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
AIRBORNE MEASUREMENTS AND OBSERVATIONS IN CIRRUS CLOUDS Interim Report
Peter V. Hobb, Lawerence F. Radke, and Donald G. Atkinson 13 Jan. 1975 117 p refs
(Contract F19628-74-C-0066; AF Proj. 627A)
(AD-A015937; AFCRL-TR-75-0249; SR-1) Avail: NTIS CSCL 04/1

Fourteen case studies of airborne measurements in cirrus clouds are described. For each case information is given on the location of the flight, the synoptic situation (with accompanying satellite IR and visible photographs), the types, sizes and mass concentrations of ice particles in the clouds, and the distribution of the ice mass concentration among particle sizes at different altitudes. From simultaneous measurements of ice mass concentrations and ice particle number concentrations, mean ice particle masses are derived: They range from about 0.3 to 30 micrograms. Low number concentrations of ice particles are generally associated with low ice mass concentrations and high number concentrations with high mass concentrations. The total ice mass concentrations in cirrus clouds generally increase with increasing temperature. Maximum values of the total ice mass concentration did not exceed the atmospheric water vapor content for water saturated conditions (about 0.1 and 1.0 g/cubic meter at -45 and -20C respectively) except when the cirrus originated from cumulonimbus tops. GRA

N76-18755# National Academy of Sciences - National Research Council, Washington, D.C.
THE OCEAN'S ROLE IN CLIMATE PREDICTION
Dec. 1974 64 p refs Sponsored in part by ONR
(Contract NSF C-310)
(AD-A016719; LC-74-29111) Avail: NTIS CSCL 04/2

This report is intended to provide an overview of the present and projected large projects currently related to the second Global Atmospheric Research Program (GARP) objective to understand the role of ocean in climate; to formulate specific questions that appear to be vital to our understanding of the role of the ocean in climate; to report on the activities that are actually taking place and to access how they stand in regard to the total task that needs to be done; and, to indicate where the first GARP Global Experiment (FGGE) provides opportunities toward understanding the ocean-atmosphere climate problem. GRA

N76-18756# Naval Postgraduate School, Monterey, Calif.
HIGH FREQUENCY TEMPERATURE FLUCTUATIONS IN THE ATMOSPHERIC BOUNDARY LAYER M.S. Thesis
Robert Thomas Simril Sep. 1975 56 p refs
(AD-A016574) Avail: NTIS CSCL 04/2

Turbulent temperature fluctuations in the atmospheric boundary layer measured at 2m, 7m and 23m in Riso, Denmark, were analyzed with particular emphasis placed on determining characteristics of the high frequency region of the spectra of these fluctuations. The shape of the high wave number one-dimensional temperature spectrum and an estimate of the Kolmogorov scalar constant were determined. Comparisons of high frequency spectral regions of temperature and velocity fluctuations were made. GRA

N76-18757# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Physical Sciences Directorate.
TURBULENCE MEASUREMENTS FROM THE ARMY GAS DYNAMICS LASER RANGE
Dorathy Anne Stewart 26 Feb. 1975 29 p refs
(DA Proj. 1T6-62621-AH-81)
(AD-A016122; RR-75-8) Avail: NTIS CSCL 04/2

This report describes wind measurements at the U.S. Army Missile Command on the test range for the Army Gas Dynamics Laser. Fast-response instruments for measuring three perpendicular components of the wind were attached at five levels on each of six towers. Approximately six minutes of data were recorded on each of nine magnetic tapes. A variance analysis was made for each case. Both power spectrum and Fourier analyses were also performed. It was concluded that the mean wind and its turbulent characteristics vary significantly from one end of the range to the other. GRA

N76-18758# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDYING SNOW STRUCTURE
N. A. Volodicheva and E. S. Troskhina 1975 7 p Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Geogr., Materially Glyatsiologicheskkh Issled. (USSR), no. 12, 1966 p 149-152
(AD-A016093; FSTC-HT-23-75-68B) Avail: NTIS CSCL 04/2

In the winters of 1961 - 62 and 1963 - 64 in the territory of the Botanical Garden of the Moscow State University (Lenin Hills), the snow structure was studied. The authors included the observations of the atmospheric precipitation which was falling, and its conversion to a snow layer under the effect of the recrystallization processes. The snowflakes were caught at a height of around 100 m, the photographing was performed with the aid of the camera 'Zenith-S' with the lens Industar-49, which provided a fourfold magnification. The equipment was fastened on a special support of the device for the microphotography, MFA-7 the photographing was done on a film with a sensitivity of 180 units with exposures of 0.5 - 1.5 seconds in daylight. GRA

N76-18759# Army Foreign Science and Technology Center, Charlottesville, Va.
DUST STORMS
P. S. Zakharov 7 Apr. 1975 232 p refs Transl. into ENGLISH of the book "Pyznye Buri", Leningrad, Gidrometeorogichiskoye Izd., 1965 164 p
(AD-A015898; FSTC-HT-23-0377-75) Avail: NTIS CSCL 04/2

The causes and conditions for formation of dust storms, the basic patterns of their appearance and their effects on agriculture, transportation, irrigation systems, orchards, etc., are given. Geographical distribution of dust storms and wind erosion in the Soviet Union is presented. Specific examples, methods of study and organizational-economic, forest ameliorative and agricultural science methods of control of dust storms are described. GRA

N76-18760# Army Engineer Topographic Labs., Fort Belvoir, Va.
WORLD AREAS WITH HIGHER PRECIPITATION INTENSITIES AND FREQUENCIES THAN THE TROPIC TEST CENTER, CANAL ZONE Research Note
Thomas E. Niebringhaus Aug. 1975 24 p refs

(DA Proj. 1T1-62112-A-528)
(AD-A016130; USAETL-RN-0022) Avail: NTIS CSCL 04/2

The report presents a series of maps showing the areas of the world that have more severe precipitation intensities and a greater frequency of days with precipitation than the Caribbean and Pacific coast sites of the Tropic Test Center in the Canal Zone, Panama. The maps provide a basis for analyzing the risk of employing Army materiel in areas where it may be subjected to more severe impact and wetting effects from precipitation than those encountered during testing. The study indicates that the Caribbean coast, as represented by Colon (Coco Solo), has more extreme precipitation intensities and frequencies than the Pacific coast, as represented by Howard Air Force Base; thus, the maps based on data from Colon show considerably smaller areas of exceedance than the maps based on data from Howard AFB. The highest precipitation intensities, the smallest areas of exceedance, and, consequently, the least risk of an operational environment being more severe than the testing environment are associated with Colon in October and November. For precipitation frequencies, the maps reveal very small areas that exceed Colon in mean annual number of days with precipitation, but considerably larger areas that have more days with precipitation than Howard AFB. GRA

N76-18761# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MEASUREMENT OF CLOUD HEIGHT, EVALUATION OF RANGING AND TRIANGULATION TECHNIQUES FOR DETERMINATION OF CLOUD HEIGHT AT AIRFIELDS Final Report
Eugene Y. Moroz and George A. Travers 29 May 1975 17 p refs
(AF Proj. 6670)
(AD-A015737; AFCRL-AFSIG-321; AFCRL-TR-75-0306) Avail: NTIS CSCL 04/2

A new evaluation of a ruby lidar ceilometer was performed at AFCRL as part of a program to evaluate the applicability of lasers to determine cloud height for airfield use. Comparitive measurements of cloud height were made with a standard Air Force rotating beam ceilometer (RBC). Examination of the test results shows the lidar indicates an accurate presentation of cloud structure. The RBC cloud return is affected by its geometry and by multiple scatter in the cloud. As a result, the measurement is not a true representation of cloud structure. These effects also bias the RBC to indicate higher cloud heights. However, the difference in cloud heights as measured by the two systems is not significant. Therefore, it is concluded that the lidar is a superior cloud height measuring device and both techniques provide operationally useful indications of cloud height.
Author (GRA)

N76-18762# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE EFFECT OF A RECTANGULAR-SCAFFOLD TOWER ON EXTINCTION COEFFICIENTS AND WINDS MEASURED IN CLOSE PROXIMITY TO THE TOWER
Donald A. Chisholm and Joseph J. Pazniokas 21 Jul. 1975 16 p refs
(AF Proj. 6670)
(AD-A015930; AFCRL-TR-75-0387; AFCRL-IP-236) Avail: NTIS CSCL 04/2

An examination of observations of extinction coefficients and winds gathered on opposite sides of a rectangular scaffold tower was conducted to determine to what extent the tower structure altered the prevailing characteristics of the atmospheric parameters. Data were gathered over a two-month period during a wide range of conditions (rain, stratus and fog, and unrestricted periods of visibility) and measurements of the variability of the observations were determined. From these studies, it was found that: (1) The tower structure does not adversely affect the prevailing homogeneity of extinction coefficient, (2) wind speed is retarded by about 10% on the lee side of the tower, and (3) wind direction is more variable on the windward side of the tower. GRA

N76-18763# Hawaii Univ., Honolulu. Dept. of Information and Computer Science.
STATISTICAL METEOROLOGY AND TIME SERIES ANALYSIS Final Scientific Report, 29 Sep. 1972 - 30 Jun. 1975
Richard H. Jones 1975 7 p refs
(Grant AF-AFOSR-2405-72; AF Proj. 9769)
(AD-A015917; AFOSR-75-1290TR) Avail: NTIS CSCL 04/2

Techniques are developed for fitting autoregressions to time series data for the purpose of prediction or spectrum estimation with application to meterology. GRA

N76-18764# Wisconsin Univ., Madison. Center for Climatic Research.
RECONSTRUCTION OF PAST CLIMATIC PROXY SERIES Final Report, 1 Jul. 1974 - 30 Jun. 1975
John E. Kutzbach 29 Aug. 1975 48 p refs
(Contracts F44620-75-C-0055; AF-AFOSR-2407-72; ARPA Order 2221-3)
(AD-A016055; AFOSR-75-1361TR) Avail: NTIS CSCL 04/2

Reconstruction of past climates from pollen data, tree-ring data and historical data is described. The pollen-climate relationships cover the past 10,000 years and deal with North America and portions of Eurasia. Detailed climatic information from 1000-year records of annually laminated lake sediments and tree-ring records in central North America (Great Lakes area) is also described. GRA

N76-18765# Oklahoma Univ., Norman.
WIND SHEAR: THERMAL WIND RELATIONSHIPS ON THE MESOSCALE Final Report, 16 Sep. 1974 - 31 May 1975
Amos Eddy and Philip A. McDonald May 1975 123 p ref
(Contract DAHC04-75-G-0035)
(AD-A013508; ARO-12813.1-R-GS) Avail: NTIS CSCL 04/2

Space-time relationships between the wind and temperature fields have been examined using rawinsonde observations taken over White Sands Missile Range and nearby locations during the period 21 August 1973 - 1 March 74. This required the bringing into operation of multivariate analysis of variance (MANOVA) and regression computer programs. Author (GRA)

N76-18565 Joint Publications Research Service, Arlington, Va.
FORECASTING METEOROLOGICAL ELEMENTS OVER A LIMITED TERRITORY BY THE PRIMITIVE EQUATIONS
V. P. Dymnikov, G. R. Kontarev, N. V. Guseva, I. V. Kolotovkin, A. G. Kulinych, N. P. Gazetova, G. V. Shemetova, L. Ye. Kaminskaya, and Z. V. Kaminskaya *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 4-14 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 6-13 (For availability see N76-18564 09-42)

N76-18567 Joint Publications Research Service, Arlington, Va.
ROLE OF ATMOSPHERIC FRONTS AND SOME CIRCULATION FACTORS IN THE DEVELOPMENT OF CONVECTION
A. I. Buz *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 24-37 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 21-30 (For availability see N76-18564 09-42)

N76-18569 Joint Publications Research Service, Arlington, Va.
INTERHEMISPHERE DIFFERENCES IN THE WIND FIELD AT ALTITUDES OF 25 - 80 km
Yu. P. Koshelkov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 47-52 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 39-43 (For availability see N76-18564 09-42)

N76-18570 Joint Publications Research Service, Arlington, Va.
RELATIVE TOTAL RADIATION AS A CLIMATIC CHARACTERISTIC OF CLOUDS
O. S. Lvova *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 53-61 refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 44-51 (For availability see N76-18564 09-42)

N76-18575 Joint Publications Research Service, Arlington, Va.
POSSIBILITY OF USING THE DATA FROM THE ROCKET METEOROLOGICAL SOUNDING NETWORK IN LONG RANGE FORECASTING
I. V. Bugayeva, G. A. Kokin, V. S. Purganskiy, L. A. Ryazanova, and D. A. Tarasenko *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 130-138 refs Transl. into

ENGLISH from Meteorol. i Gidrol. (Moscow), no. 9, 1975 p 102-106 (For availability see N76-18564 09-42)

N76-18576 Joint Publications Research Service, Arlington, Va.
AMERICAN RESEARCH ON THE WEATHER MODIFICATION PROBLEM
Yu. S. Sedunov *In its* Meteorology and Hydrol., No. 9 (JPRS-66453) 29 Dec. 1975 p 139-148 Transl. into ENGLISH from Meteorol. i Gidrol (Moscow), no. 9, 1975 p 107-111 (For availability see N76-18564 09-42)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-18766 Texas A&M Univ., College Station.
HYDROTHERMAL PROCESSES ALONG MID-OCEAN RIDGES: AN EXPERIMENTAL INVESTIGATION Ph.D. Thesis
Andrew Hajash, Jr. 1975 70 p
Avail: Univ. Microfilms Order No. 76-3638

High-temperature seawater/basalt interactions were investigated. It was found that as seawater reacts with basalt between 200 and 500 C at 500-800 bars, the fluid tends to change from an oxygenated, slightly alkaline, Na(+), Mg(++), SO4, Cl(-) solution to a reducing acidic, Na(+), Ca(++), Cl(-) solution with increased Fe, Mn and Cu concentrations. Silica concentrations approach saturation values with respect to quartz at all temperatures; however, Al abundances remain very low. These data imply that large-scale circulation of seawater in the oceanic crust could account for the Al-deficient metalliferous sediments associated with mid-ocean ridges and be important in the genesis of certain Fe-Cu sulfide ore deposits. The process could also affect the geochemical budgets of certain elements and exert substantial control on the steady state composition of seawater by removing excess Na and Mg and adding Ca, Si, and H.
Dissert. Abstr.

N76-18767 Miami Univ., Coral Gables, Fla.
WIND-FORCES CONTINENTAL SHELF WAVES IN THE FLORIDA CURRENT Ph.D. Thesis
David Arthur Brooks 1975 281 p
Avail: Univ. Microfilms Order No. 76-4680

The significance of the wind as a generating mechanism for low (subinertial) frequency Florida current fluctuations is examined. A model of the Florida Straits bottom topography and a baroclinic, steady mean current is considered. An approximate potential vorticity governing equation for the lowest order (barotropic) fluctuation mode is derived. The relative vorticity due to horizontal shear of the mean current is included in the model. An examination of low-passed temperature data from thermistor strings moored on the Miami and Bimini sides of the Straits shows that the thermal field on both sides in both seasons responds to wind events in the manner expected from simple coastal upwelling theory. It is shown that vertical motions are primarily responsible for the observed temperature fluctuations, especially in the winter. The observed nonsolar vertical temperature variance distribution is found to be consistent with that predicted by superimposing a barotropic wave motion on the mean baroclinic thermal field.
Dissert. Abstr.

N76-18768 California Univ., Los Angeles.
NUMERICAL SIMULATION OF MESOSCALE OCEAN EDDIES Ph.D. Thesis
Young-June Han 1975 170 p
Avail: Univ. Microfilms Order No. 76-3070

A simulation was performed using a five level model which had a horizontal grid size of approximately 40 km and which extends from lattitude 16 degrees N to 55 degrees N and is 40 degrees of longitude wide. The circulation was driven by a prescribed steady planetary-scale zonal wind stress and thermal forcing. The numerical experiment was performed in two phases. In the spin-up phase of 28 years of simulated time, a course grid resolution (120 km x 120 km) was used. In the second phase of 1300 days of simulated time, a fine grid resolution (40 km x 40 km) was used. The initial condition of the second phase was obtained by interpolations from the instantaneous fields at the end of the spin-up phase. An analysis of the energy transformations shows that, averaged for the entire model ocean, the kinetic energy of the time averaged flow of the fine grid resolution is converted into eddy kinetic energy, and that almost all of this energy conversion takes place as a result of a horizontal shear instability.
Dissert. Abstr.

N76-18769*# National Academy of Sciences - National Research Council, Washington, D.C.
MARINE AND MARITIME USES Practical Applications of Space Systems
1975 46 p refs
(Contract NSR-09-012-106)
(NASA-CR-146409; Paper-8) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 08J

Activities related to: (1) understanding, controlling, and using the ocean's biological and physical processes for food and energy production and ship design purposes, and (2) providing navigation, communication, and data transmission technological aids which improve efficiency and enhance safety in maritime operations are disclosed.
Author

N76-18770*# Radiometric Technology, Inc., Wakefield, Mass.
OCEAN FOAM GENERATION AND MODELING Final Report
Ronald A. Porter and Kenneth P. Bechis 20 Jan. 1976 77 p refs
(Contract NAS1-13126)
(NASA-CR-144922) Avail: NTIS HC $5.00 CSCL 08J

A laboratory investigation was conducted to determine the physical and microwave properties of ocean foam. Special foam generators were designed and fabricated, using porous glass sheets, known as glass frits, as the principal element. The glass frit was sealed into a water-tight vertical box, a few centimeters from the bottom. Compressed air, applied to the lower chamber, created ocean foam from sea water lying on the frit. Foam heights of 30 cm were readily achieved, with relatively low air pressures. Special photographic techniques and analytical procedures were employed to determine foam bubble size distributions. In addition, the percentage water content of ocean foam was determined with the aid of a particulate sampling procedure. A glass frit foam generator, with pore diameters in the range 70 - 100 micrometers, produced foam with bubble distributions very similar to those found on the surface of natural ocean foam patches.
Author

N76-18771*# Virginia Inst. of Marine Science, Gloucester Point. Div. of Biological Oceanography.
REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHESAPEAKE BAY Final Report
Robert J. Orth and Hayden Gordon Apr. 1975 70 p refs
(Contract NAS1-10720)
(NASA-CR-144918) Avail: NTIS HC $4.50 CSCL 08A

An experimental water penetration film and black and white near infrared film were used to study the distribution of submerged aquatic vegetation in the lower Chesapeake Bay. Detailed description of the grass beds was obtained by flying at an altitude of 5,000 feet, at low tide when wind conditions were minimal. Results show that there was a 36% reduction in the amount of submerged aquatic vegetation in the lower Chesapeake Bay from 1971 to 1974, the greatest losses occurring in the York, Piankatank and Rappahannock rivers (tabulated data is given). Recovery of some grass beds occurs primarily through seedling recruitment and subsequent vegetative growth. Cownose rays are suspected as a main factor for the decimation of some of the grass beds. Maps and photographs of the areas studied are given.
Author

N76-18772# Defence Research Establishment Pacific, Victoria (British Columbia).
THE INTERACTION OF WIND WAVES AND INTERNAL WAVES: THEORETICAL ANALYSIS
B. A. Hughes Jul. 1975 89 p refs
(AD-A016648; DREP-73-3) Avail: NTIS CSCL 04/2

A theoretical description is given of the behavior of a

broadband, small-amplitude wind-wave field to a perturbing internal wave velocity pattern. The theory includes the effect of the local wind. Specific predictions are made for the case of weak internal wave currents, and these predictions are compared to measurements. The theory predicts the magnitude of the mean-square-slope changes reasonably well, and it predicts the quadrant of the phases correctly. General features of the perturbed surface-wave energy spectrum integrated in an angle are also predicted reasonbly well, and comparisons are made of the theoretical and measured local integrated spectrum at roughened areas and at slick areas. Various conditions for two theoretical wind-wave spectra are used to predict the sensitivity (or magnitude of mean-square-slope change per unit-current change, suitably normalized) and phase of the slope field as functions of the wind. Representative calculations are also made to provide sensitivity and phase of mean-square height and mean-square curvature as functions of the wind. It is shown that the 'weak internal wave' analysis leads to a singular perturbation series, and a method for obtaining a uniformly valid expansion is given and explored in detail. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-18773# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).

CYTOCROME 553 OF THE ALGA BUMILLERIOPSIS FILIFORMIS

H.-J. Lach, H. G. Ruppel, and P. Boeger 1976 28 p refs Transl. into ENGLISH from Z. Pflanzenphysiol. (Stuttgart), v. 70, no. 5, 1973 p 432-451

(NRC/CNR-TT-1844) Avail: NTIS HC $4.00

Cytochrome 553 of the alga Bumilleriopsis filiformis Vischer (Chrysophycease) was purified to apparent homogeneity; disc electrophoresis gave only a single band. Some physical and chemical properties are described. It is an f-type cytochrome localized in the plastids and present in a molar ratio of 1 to 300-400 chlorophyll molecules under the culture conditions used. Author

N76-18774*# California Univ., Berkeley. White Mountain Research Station.

PHYSIOLOGICAL RESPONSES TO ENVIRONMENTAL FACTORS RELATED TO SPACE FLIGHT Semiannual Status Report, 1 Feb. - 31 Jul. 1975

Nello Pace, Benjamin W. Grunbaum, Arthur M. Kodama, Richard C. Mains, and Donald F. Rahlmann 31 Jul. 1975 65 p

(Grant NGL-05-003-024)

(NASA-CR-146423; SASR-27) Avail: NTIS HC $4.50 CSCL 06S

Physiological procedures and instrumentation developed for the measurement of hemodynamic and metabolic parameters during prolonged periods of weightlessness are described along with the physiological response of monkeys to weightlessness. Specific areas examined include: cardiovascular studies; thyroid function; blood oxygen transport; growth and reproduction; excreta analysis for metabolic balance studies; and electrophoretic separation of creatine phosphokinase isoenzymes in human blood. J.M.S.

N76-18775*# Food and Drug Administration, Cincinnati, Ohio. Food Research Lab.

ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jul. - 30 Sep. 1975

A. L. Reyes and J. E. Campbell Dec. 1975 16 p refs Submitted for publication

(NASA Order W-13411)

(NASA-CR-146429; QPR-42) Avail: NTIS HC $3.50 CSCL 06M

Statistical techniques which have relevance to studies on the thermal inactivation on bacterial spores are discussed. Author

N76-18776# Armed Forces Radiobiology Research Inst., Bethesda, Md.

OCTOPAMINE RECEPTORS ON APLYSIA NEURONS: FURTHER EVIDENCE FOR A FUNCTION OF OCTOPAMINE AS A NEUROTRANSMITTER

D. O. Carpenter and G. L. Gaubatz May 1975 14 p refs Sponsored by Defense Nuclear Agency

(DNA Proj. NWED-QAXMC912)

(AD-A013030; AFRRI-SR75-12) Avail: NTIS CSCL 06/15

Some neurons in Aplysia have receptors which are much more sensitive to octopamine than any other structurally related compound. Most such receptors mediate a hyperpolarizing conductance increase to K(+). These responses when considered with the octopamine content of whole ganglia and single neurons strongly suggest that octopamine is a neurotransmitter in Aplysia. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-18777 Florida State Univ., Tallahassee.

THE EFFECTS OF A MUSCLE ENDURANCE TRAINING PROGRAM ON CARDIOVASCULAR FUNCTION AS MEASURED ON THE BICYCLE ERGOMETER Ph.D. Thesis

William Thomas Boone 1975 65 p

Avail: Univ. Microfilms Order No. 76-2626

Pretests and posttests were administered prior to and immediately after the training period in order to evaluate the effects of the training program. Forty male college students participated in the study. Steady state and exhaustive exercise measurements were used to determine the effects of the training program on selected cardiovascular parameters. The physiological parameters examined in this study were: (1) metabolic functions (oxygen uptake, arteriovenous oxygen difference, oxygen pulse, and peak oxygen pulse), (2) hemodynamics (cardiac output, stroke volume, and heart rate), (3) thigh circumference, strength and endurance measurements, and (4) physical work capacity. The data for all variables were subjected to separate analyses of covariance. Results indicated significant differences between the adjusted posttest means for each of the following variables: resting heart rate, steady state heart rate, and muscle endurance. Dissert. Abstr.

N76-18778*# Transemantics, Inc., Washington, D.C.

TEST OF MODELIZATION FOR SWEATING DURING MUSCULAR EXERCISE

Jean Timbal, Monique Loncle, Jean Durand-Bailloud, and Charles Boutelier NASA Mar. 1976 11 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Paris), v. 169, no. 4, 1975 p 872-876

(Contract NASw-2792)

(NASA-TT-F-16908) Avail: NTIS HC $3.50 CSCL 06A

From a practical viewpoint, thermal sweating during exercise can be described by an exponential equation. The errors obtained by using this mathematical model are of minor importance. Nevertheless, metrological and physiological factors can theoretically complicate the model. Author

N76-18779*# Joint Publications Research Service, Arlington, Va.

BODY FUNCTIONS AND METABOLISM DURING PROLONGED HYPOKINESIA IN AN INTEGRATED EXPERIMENT

Ye. A. Kovalenko, E. S. Mailyan, V. L. Popkov, Yu. S. Galushko, A. A. Prokhonchukov, Z. S. Dopgun, Yu. I. Kondratyev, M. I. Kozar, G. P. Tikhonova, and A. G. Kolesnik Washington NASA Feb. 1976 39 p refs Transl. into ENGLISH from Usp. Fiziol. Nauk (USSR), v. 6, no. 3, 1975 p 110-136

(NASA Order W-13183)

(NASA-TT-F-16882) Avail: NTIS HC $4.00 CSCL 06S

The effect of prolonged hypokinesia was studied on white rats in special restraining cages. Significant changes in total gas and energy metabolisms as well as in tissue oxidative processes were observed. A sharp retardation of weight increase and a

significant retardation of growth in the muscular system developed. Significant deviations arose in mineral and protein metabolism indices and tissue structures of the myocardium and liver became disturbed. It was shown that prolonged hypokinesia is accompanied by phasic changes in functional activity of the hypophyseal/adrenal system and the thymolymphatic apparatus, as well as by disturbance of the serotonin metabolism. Transition to normal motor activity does not normalize hypophyseal/adrenal system and serotonin metabolism for 30 to 40 days. Author

N76-18780*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PHYSIOLOGY AND BIOCHEMISTRY OF TOTAL BODY IMMOBILIZATION IN ANIMALS: A COMPENDIUM OF RESEARCH
Karen J. Dorchak and John E. Greenleaf Washington Feb. 1976 53 p refs
(NASA-TM-X-3306; A-6039) Avail: NTIS HC $4.50 CSCL 06S

Major studies that describe the physiological and biochemical mechanisms which operate during total body restraint (confinement in cages for example) are presented. The metabolism and behavior of various animals used in medical research (dogs, monkeys, rats, fowl) was investigated and wherever possible a detailed annotation for each study is provided under the subheadings: (a) purposes, (b) procedures and methods, (c) results, and (d) conclusions. Selected references are also included. Author

N76-18781*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHYSIOLOGIC RESPONSES TO WATER IMMERSION IN MAN: A COMPENDIUM OF RESEARCH
James Kollias, Dena VanDerveer, Karen J. Dorchak, and John E. Greenleaf Washington Feb. 1976 90 p refs
(NASA-TM-X-3308; A-6038) Avail: NTIS HC $5.00 CSCL 06S

A total of 221 reports published through December 1973 in the area of physiologic responses to water immersion in man were summarized. The author's abstract or summary was used whenever possible. Otherwise, a detailed annotation was provided under the subheadings: (1) purpose, (2) procedures and methods, (3) results, and (4) conclusions. The annotations are in alphabetical order by first author; author and subject indexes are included. Additional references are provided in the selected bibliography. Author

N76-18782*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LIQUID-COOLED BRASSIERE Patent Application
William Elkins (Acurex Corp.), Bill Alvin Williams, and Ernest Glenn Tickner, inventors (to NASA) (Acurex Corp.) Filed 27 Jan. 1976 18 p
(NASA-Case-ARC-11007-1; US-Patent-Appl-SN-652948) Avail: NTIS HC $3.50 CSCL 06B

A device is described for enhancing the detection of malignant tissue in the breasts of a woman. It is comprised of a brassiere-like garment which is fitted with a pair of liquid-perfused cooling panels which completely and compliantly cover the breasts and upper torso. The garment is connected by plastic tubing to a liquid cooling system composed of a fluid pump, a solenoid control valve for controlling the flow of fluid to either the cooling unit or the heating unit, a fluid reservoir, a temperature sensor in the reservoir, and a restrictor valve to control the pressure in the garment inlet cooling line. NASA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-18783*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
RESEARCH ON HABITUATION TO NOVEL VISUAL-VESTIBULAR ENVIRONMENTS WITH PARTICULAR REFERENCE TO SPACE FLIGHT Progress Report, Mar. 1975 - Feb. 1976
Laurence R. Young 27 Feb. 1976 114 p refs
(Grant NsG-2032)
(NASA-CR-146280) Avail: NTIS HC $5.50 CSCL 05E

Progress in the development of a cohesive theory of the underlying physiological mechanisms associated with spatial orientation in unusual environments is described. Results can be applied to providing means of preventing and/or minimizing the space motion sickness which has been observed during prolonged space missions. Three major areas were investigated: (1) the interaction of visual and vestibular cues in conflict in the human, (2) the plasticity of the vestibulo-ocular reflex in monkeys, and (3) end organ function in the ray with particular emphasis on the effect of ionic concentration. Author

N76-18784# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
LOW VISIBILITY LANDING PILOT MODELING EXPERIMENT AND DATA, PHASE 2 Final Report, Oct. - Nov. 1974
R. Gressang Aug. 1975 220 p refs
(Contract DOT-FA70WAI-173; AF Proj. 2187)
(AD-A016764; AFFDL-TR-75-57) Avail: NTIS CSCL 01/2

This report describes an experiment to collect data for modeling pilot behavior during low visibility approach and landing. The data are presented in a form suitable for use in forming a pilot model of the optimal control type. The experiment was conducted as a part of Phase 2 of a low visibility landing simulation program (LOVISIM) conducted at the Air Force Flight Dynamics Laboratory and sponsored by the Federal Aviation Administration. GRA

N76-18785# Air Force Human Resources Lab., Brooks AFB, Tex.
DESIGN OF A COMPUTER-CONTROLLED, RADOM-ACCESS SLIDE PROJECTOR INTERFACE Final Report, Apr. - Nov. 1974
Paul J. Kirby, Edward M. Gardner, and Lyle R. McKnight Aug. 1975 24 p
(AF Proj. 1121)
(AD-A016726; AFHRL-TR-75-20) Avail: NTIS CSCL 05/9

The Technical Training Division of the Air Force Human Resources Laboratory has a research and development mission to improve Air Force training through the application of instructional and computer technology in the administration and management of individualized instruction. Within this new pedagogic environment, a computer-controlled random-access image projection capability is desired. This is a report on the successful design, development, test and evaluation of an electronic hardware device interfacing a commercially available slide projector with a plasma panel computer terminal. The interface device allows an instructional computer program to select slides for viewing based upon the lesson/student situation parameters of the instructional strategy employed. GRA

N76-18786# Army Materiel Command, Texarkana, Tex. Intern Training Center.
VISUAL PERFORMANCE UNDER MONOCHROMATIC ILLUMINATION AND SCOTOPIC VISION CONDITIONS Final Report
John G. Delgado Jun. 1975 57 p refs
(AD-A016790; USAMC-ITC-02-08-75-113) Avail: NTIS CSCL 05/5

The objective of this report was to investigate the effect of different colors of illumination on visual performance. The experiment was conducted in a dark room in order to simulate nighttime conditions. Three colors of illumination were selected and the visual performance of ten subjects was examined at three illumination intensity levels. The three colors selected for testing were red, blue, and amber. Task scores, obtained from a manipulative dexterity task, were used to evaluate visual performance. A three-factor, randomized block design model was used to analyze the data of the experiment. The color of illumination, for a manipulative dexterity task, was found to have no significant effect on visual performance at a 5 percent level of significance. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-18787*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
SHUTTLE ENVIRONMENTAL AND THERMAL CONTROL/LIFE SUPPORT SYSTEM COMPUTER PROGRAM, SUPPLEMENT 1 Final Report
W. J. Ayotte Dec. 1975 159 p
(Contract NAS9-12411)
(NASA-CR-147434; SVHSER-6529-Suppl-1) Avail: NTIS HC $6.75 CSCL 06K

The computer programs developed to simulate the RSECS (Representative Shuttle Environmental Control System) were described. These programs were prepared to provide pretest predictions, post-test analysis and real time problem analysis for RSECS test planning and evaluation. Author

N76-18788*# Stanford Research Inst., Menlo Park, Calif.
ADVANCED RECORDING AND PREPROCESSING OF PHYSIOLOGICAL SIGNALS Final Report, May - Oct. 1975
Philip B. Bentley Nov. 1975 89 p refs
(Contract NAS2-8836; SRI Proj. 4260)
(NASA-CR-137795) Avail: NTIS HC $5.00 CSCL 06D

The measurement of the volume flow-rate of blood in an artery or vein requires both an estimate of the flow velocity and its spatial distribution and the corresponding cross-sectional area. Transcutaneous measurements of these parameters can be performed using ultrasonic techniques that are analogous to the measurement of moving objects by use of a radar. Modern digital data recording and preprocessing methods were applied to the measurement of blood-flow velocity by means of the CW Doppler ultrasonic technique. Only the average flow velocity was measured and no distribution or size information was obtained. Evaluations of current flowmeter design and performance, ultrasonic transducer fabrication methods, and other related items are given. The main thrust was the development of effective data-handling and processing methods by application of modern digital techniques. The evaluation resulted in useful improvements in both the flowmeter instrumentation and the ultrasonic transducers. Effective digital processing algorithms that provided enhanced blood-flow measurement accuracy and sensitivity were developed. Block diagrams illustrative of the equipment setup are included. Author

N76-18789*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.
MODULAR BIOWASTE MONITORING SYSTEM Final Report
G. L. Fogal Dec. 1975 203 p
(Contract NAS9-13748)
(NASA-CR-147483; Doc-76SDS4200) Avail: NTIS HC $7.75 CSCL 06K

The objective of the Modular Biowaste Monitoring System Program was to generate and evaluate hardware for supporting shuttle life science experimental and diagnostic programs. An initial conceptual design effort established requirements and defined an overall modular system for the collection, measurement, sampling and storage of urine and feces biowastes. This conceptual design effort was followed by the design, fabrication and performance evaluation of a flight prototype model urine collection, volume measurement and sampling capability. No operational or performance deficiencies were uncovered as a result of the performance evaluation tests. Author

N76-18790*# Martin Marietta Corp., Denver, Colo.
ZERO LIQUID CARRYOVER WHOLE-BODY SHOWER VORTEX LIQUID/GAS SEPARATOR Final Report
Dec. 1975 148 p refs
(Contract NAS9-14577)
(NASA-CR-147500; MCR-76-10) Avail: NTIS HC $6.00 CSCL 06K

The development and evaluation of a liquid/gas vortex type separator design eliminating liquid and semi-liquid (suds) carryover into air recirculating system were described. Consideration was given to a number of soaps other than the 'Miranol JEM' which was the low sudsing soap used in previous test runs of the space shower. Analysis of test parameters and prototype testing resulted in a revised separator configuration and a better understanding of the suds generating mechanism in the waste-water collection system. The final design of the new separator provides for a wider choice of soaps without leading to the problem of 'carryover'. Furthermore, no changes in separator-to-shower interfaces were required. The new separator was retrofitted on the 'space shower' and satisfactorily demonstrated in one-g testing. Author

N76-18791*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB FOOD SYSTEM
Thomas R. Turner and J. Dennis Sanford (Technology, Inc., Houston, Tex.) Oct. 1974 44 p
(NASA-TM-X-58139; JSC-09159) Avail: NTIS HC $4.00 CSCL 06H

A review of the Skylab food system requirements, package designs, and launch configurations was presented. In-flight anomalies were discussed, and between-mission changes in design were described. A discussion of support for Skylab 3 and Skylab 4 mission extensions and of new items launched on these missions is included. Author

N76-18792*# Stanford Research Inst., Menlo Park, Calif.
A TACTILE PAGING SYSTEM FOR DEAF-BLIND PEOPLE, PHASE 1
James A. Baer Feb. 1976 28 p refs
(Contract NAS2-8711; SRI Proj. 3980)
(NASA-CR-137816) Avail: NTIS HC $4.00 CSCL 05H

A tactile paging system for deaf-blind people has been brought from the concept stage to the development of a first model. The model consists of a central station that transmits coded information via radio link to an on-body (i.e., worn on the wrist) receiving unit, the output from which is a coded vibrotactile signal. The model is a combination of commercially available equipment, customized electronic circuits, and electromechanical transducers. The paging system facilitates communication to deaf-blind clients in an institutional environment as an aid in their training and other activities. Several subunits of the system were individually developed, tested, and integrated into an operating system ready for experimentation and evaluation. The operation and characteristics of the system are described and photographs are shown. Author

N76-18793# Payne, Inc., Annapolis, Md.
STABILITY AND LIMB DISLODGEMENT FORCE MEASUREMENTS WITH THE F-105 AND ACES-2 EJECTION SEATS Final Report, 1 Nov. 1973 - 31 Jan. 1975
Peter R. Payne, Fred W. Hawker, and Anthony J. Euler Jul. 1975 65 p refs
(Contract F33615-74-C-4015; AF Proj. 7231)
(AD-A015726; AMRL-TR-75-8; Working-Paper-119-7) Avail: NTIS CSCL 01/3

Forces on the arms and legs of test subjects seated in the F-105 and ACES-II ejection seats were measured over a range of speeds in a wind tunnel. It was found that the forces varied considerably between individuals. The variation was not identified with any outwardly visible physical features of the individuals. Averaged values for the group were compared over a range of pitch and yaw angles and between two different seats. Outward force at the knee was found to vary systematically with yaw angle up to 30 deg, and to be little affected by pitch, and to be practically the same on both seats. Forces at the feet and hands showed less systematic variation and were different between the two seats. Attempts to modify the forces by appurtenances attached to the limbs succeeded only in reducing them for some conditions at the expense of others. Both seats were shown to be statically unstable, with and without occupant, in free flight. Static stability was exhibited when equipped with an array of in-plane stabilizer plates on both the F-105 and ACES-II ejection seats. Pressures inside the helmet, and overall forces tending to remove it, were also measured. Powerful lift forces were derived from low pressures over the outside, quite sufficient to ensure helmet loss at high speed, unless the

retention strap is designed to react large loads; in which case, some form of neck injury can be anticipated. GRA

N76-18794# Wisconsin Univ., Madison. Dept. of Industrial Engineering.
VISUAL DYNAMICS WHEN INTERRUPTING A CONTROL TASK TO SEARCH FOR A PERIPHERAL TARGET
Gordon H. Robinson and Jeffrey R. Bond 15 Oct. 1975 31 p refs
(Contract N00014-75-C-0364; NR Proj. 197-028)
(AD-A016838; TR-75-21) Avail: NTIS CSCL 05/8

The dynamic patterns of eye and head movements were measured when the subject interrupted a manual control task to visually process a peripheral, digital target. The initial pattern of movement differs both quantitatively and qualitatively from that reported in 'classic' studies without the competing, central, ongoing task. A compensatory eye/head movement period was observed wherein the head began movement toward the target while fixation remained on the control task display. The initial saccadic eye movement was delayed approximately 300 msec over the classic paradigm. Control order (plant dynamics) and control signal bandwidth have effects on this pattern as does the status of control at the time search is commanded. GRA

N76-18795# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
EFFECT OF PROPOSED B-1 PROTECTIVE SMOKE HOOD ON VISUAL PSYCHOMOTOR PERFORMANCE Final Technical Report
Morton K. Ohlbaum and Abbott T. Kissen Aug. 1975 9 p
(AF Proj. 7222)
(AD-A015733; AMRL-TR-75-55) Avail: NTIS CSCL 06/11

Potential in-flight emergencies on contemporary aircraft include smoke in the cockpit even without patent fire. In order to avoid eye irritation, the use of a plastic hood to isolate the face of the aviator from the smoke has been proposed. Investigation of visual psychomotor performance indicates that the hood may be marginally satisfactory for very brief time periods, but completely unsatisfactory and potentially hazardous when in work for five minutes or more. Author (GRA)

N76-18796# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
WIND TUNNEL TESTS OF A USAF FLIGHT HELMET AND LOSS PREVENTER Interim Report, Oct. 1973 - Oct. 1974
James W. Brinkley Aug. 1975 16 p ref
(AF Proj. 7231)
(AD-A015734; AMRL-TR-75-75) Avail: NTIS CSCL 06/17

An experimental effort was accomplished to measure the aerodynamic forces that act upon a crewman's flight helmet during use of an aircraft emergency escape system. Tests were accomplished within a low speed wind tunnel using volunteer subjects seated within an ACES II escape system. The wind velocity was varied to produce dynamic pressures ranging from 10 to 50 lb per sq ft. The pitch angle of the seat and subject were varied -2 to +73 degs. The yaw angle was varied from 0 to 30 degs. Author (GRA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-18797 Utah Univ., Salt Lake City.
THE AUTOMATIC SENSING AND ANALYSIS OF THREE-DIMENSIONAL SURFACE POINTS FROM VISUAL SCENES Ph.D Thesis
Henry Fuchs 1975 92 p
Avail: Univ. Microfilms Order No. 76-4547

The design and implementation of a new range measuring sensing device and an associated software algorithm for constructing surface descriptions of arbituary three dimensional objects from single or multiple views are described. The sensing device, which measures surface points from objects in its environment, is a computer-controlled, random-access, triangulating rangefinder with a mirror-deflected laser beam and revolving disc detectors. The algorithm developed processes these surface points and generates, in a deterministic fashion, complete surface descriptions of all encountered objects. In its processing, the algorithm also detects parts of objects for which there is insufficient data, and can supply the sensing device with the control parameters needed to successfully measure the uncharted regions. The resulting object descriptions are suitable for use in a number of areas, such as computer graphics. Dissert. Abstr.

N76-18798 Houston Univ., Tex.
PROBABILISTIC SEQUENTIAL MACHINE MODELING OF COMPUTER SYSTEMS AND ITS APPLICATION TO ERROR DETECTION Ph.D. Thesis
Hitohisa Asai 1975 242 p
Avail: Univ. Microfilms Order No. 76-3760

Probabilistic sequential machine modeling of a computer system is proposed by considering input/output flexibilities on the probabilistic sequential machine theory. With the model, a theoretical approach and a practical approach to error detection are presented. In the theoretical approach, a two-state isolated machine, which contains the well-known completely isolated machine as a subset, is constructed, and a decomposition method of a probabilistic sequential machine into two-state probabilistic sequential machines is studied. From distribution of input types to and output channel activities from a computer system, the probability of subsystem activities in a steady state is determined in the practical approach by an optimization of a nonlinear programming problem. Dissert. Abstr.

N76-18799 California Univ., Los Angeles.
A NEW COMPUTER CRYPTOGRAPHY: THE EXPANDED CHARACTER SET (ECS) CIPHER Ph.D. Thesis
Charlie Edmund Neat 1975 325 p
Avail: Univ. Microfilms Order No. 76-3048

A cryptographic technique, the ECS Cipher was developed for the privacy protection of programs and data in computer systems. The ECS Cipher is a new multisubstitution (MS) cipher that provides each cipher user with the capability of controlling the privacy protection for his programs and data. The algorithms for ECS encipherment, decipherment, and decryption are presented, and the ECS Cipher implementation is described. The encipherment and decryption performances of the ECS Cipher and the costs incurred by both cipher user and intruder are

discussed. To obtain a reduction in computer system overhead when using the ECS Cipher, a data set assignment algorithm (DSAA) was developed which reduces the total seek time for ECS Ciphered data sets in sequential storage. An example of using the DSAA to assign data sets within a sequential store is presented. Dissert. Abstr.

N76-18800* National Aeronautics and Space Administration. Pasadena Office, Calif.
PRIORITY INTERRUPT SYSTEM Patent
Harvey L. Jeane, inventor (to NASA) (JPL) Issued 13 Aug. 1974 11 p Filed 24 Jul. 1972 Sponsored by NASA
(NASA-Case-NPO-13067-1; US-Patent-3,829,839; US-Patent-Appl-SN-274348; US-Patent-Class-340-172.5) Avail: US Patent Office CSCL 09B

A priority interrupt system is described. In the system, designed to accommodate up to n interrupts of different priority levels, each of the registers is of n bits, with the orders of the bits in the registers corresponding to the priority levels of the different interrupts. The highest order set bit in the push pop register indicates the priority level of the interrupt for which a subroutine is executed. Any lower order set bit indicates in priority level of an interrupt for which a subroutine was previously started and interrupted to service a subsequently received interrupt of a higher priority level. The subroutines are structured so that when a subroutine is completed the highest order set bit in the push pop register is reset and the controlled computer automatically returns to complete the subroutine associated with the next highest order set bit in the push pop register.
Official Gazette of the U.S. Patent Office

N76-18801*# IBM Federal Systems Div., Huntsville, Ala.
TECHNICAL DESCRIPTION OF SPACE ULTRA RELIABLE MODULAR COMPUTER (SUMC), MODEL 2 B Final Report
31 Dec. 1975 235 p
(Contract NAS8-29929)
(NASA-CR-144184; IBM-76W-00013) Avail: NTIS HC $8.00 CSCL 09B

The design features of the SUMC-2B computer, also called the IBM-HTC are described. It is general purpose digital computer implemented with flexible hardware elements and microprogramming to enable low cost customizing to a wide range of applications. It executes the S/360 standard instruction set to maintain problem state compability. Memory technology, extended instruction sets, and I/O channel variations are among the available options. Author

N76-18802*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN INTERACTIVE SCENE ANALYSIS Annual Report
Jay M. Tenenbaum, Thomas D. Garvey, Stephen Weyl, and Helen C. Wolf Mar. 1975 131 p refs
(Contract NASw-2086; SRI Proj. 8721)
(NASA-CR-146294) Avail: NTIS HC $6.00 CSCL 09B

An interactive scene interpretation system (ISIS) was developed as a tool for constructing and experimenting with man-machine and automatic scene analysis methods tailored for particular image domains. A recently developed region analysis subsystem based on the paradigm of Brice and Fennema is described. Using this subsystem a series of experiments was conducted to determine good criteria for initially partitioning a scene into atomic regions and for merging these regions into a final partition of the scene along object boundaries. Semantic (problem-dependent) knowledge is essential for complete, correct partitions of complex real-world scenes. An interactive approach to semantic scene segmentation was developed and demonstrated on both landscape and indoor scenes. This approach provides a reasonable methodology for segmenting scenes that cannot be processed completely automatically, and is a promising basis for a future automatic system. A program is described that can automatically generate strategies for finding specific objects in a scene based on manually designated pictorial examples. Author

N76-18803*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-DIMENSIONAL RADIANT ENERGY ARRAY COMPUTERS AND COMPUTING DEVICES Patent Application
David H. Schaeffer and James P. Strong, III, inventors (to NASA) Filed 13 Feb. 1976 78 p
(NASA-Case-GSC-11839-2; US-Patent-Appl-SN-657996) Avail: NTIS HC $5.00 CSCL 09B

Two-dimensional digital computers and computer devices are operated in parallel on rectangular arrays of digital radiant energy optical signal elements which are arranged in ordered rows and columns. Logic gate devices receive two input arrays and provide an output array having digital states dependent only on the digital states of the signal elements of the two input arrays at corresponding row and column positions. The logic devices include and array of photoconductors responsive to at least one of the input arrays for either selectively accelerating electrons to a phosphor output surface, applying potentials to an electroluminescent output layer, exciting an array of discrete radiant energy sources, or exciting a liquid crystal to influence crystal transparency or reflectivity. NASA

N76-18804*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-DIMENSIONAL RADIANT ENERGY ARRAY COMPUTERS AND COMPUTING DEVICES Patent Application
David H. Schaeffer and James P. Strong, III, inventors (to NASA) Filed 13 Feb. 1976 65 p
(NASA-Case-GSC-11839-3; US-Patent-Appl-SN-657997) Avail: NTIS HC $4.50 CSCL 09B

An analog to digital converter is described for two dimensional radiant energy array computers. The converter stage derives (1) a bit array of digital radiant energy signals representative of the amplitudes of an input radiant energy analog signal and (2) an output radiant analog signal array to serve as an input to succeeding stages. A digital radiant energy array device is used which contains radiant energy array positions so that the analog array is less than a predetermined threshold level. A scaling device which amplifiers the radiant energy signal levels of the input array is included. The digital array corresponds to the analog threshold level. An adder device adds the signals of the scaled input and digital arrays at corresponding array positions to form the output analog array. NASA

N76-18805*# SCI Systems, Inc., Huntsville, Ala.
DATA MANAGEMENT SYSTEM DIU TEST SYSTEM Final Technical Report
Feb. 1976 92 p
(Contract NAS8-31443)
(NASA-CR-144195) Avail: NTIS HC $5.00 CSCL 09B

An operational and functional description is given of the data management system. Descriptions are included for the test control unit, analog stimulus panel, discrete stimulus panel, and the precision source. The mechanical configuration is defined and illustrated to provide card and component location for modification or repair. The unit level interfaces are mirror images of the DIU interfaces and are described in the Final Technical Report for NASA-MSFC contract NAS8-29155. Author

N76-18806# National Aviation Facilities Experimental Center, Atlantic City, N.J.
COMPUTER DISPLAY PANEL OR 9020E COMPUTER SIMULATOR INTERFACE DEVICE Final Report
John D. Riley Nov. 1975 105 p refs
(FAA Proj. 121-101-050)
(AD-A019338/3; FAA-NA-75-17) Avail: NTIS HC $5.50 CSCL 09/2

The computer display channel (CESID) was designed and fabricated to simulate computer display channel or 9020E computer output status messages to the systems maintenance monitor console for the purpose of verifying that the systems maintenance monitor console conformed with its test specification. The CESID permits testing of the systems maintenance monitor console without interference to the computer display channel or the 9020E computer. The CESID performed well in tests of the systems maintenance monitor console. The CESID is an excellent trouble-shooting tool for computer display channel or 9020E computer monitoring portions of the systems maintenance monitor console. Author

N76-18807# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A COMPLETE UNIFICATION ALGORITHM FOR ASSOCIATIVE COMMUTATIVE FUNCTIONS
Mark E. Stickel Jun. 1975 21 p refs
(Contract F44620-73-C-0074; Grant NSF GJ-28457; ARPA Order 2466)
(AD-A015846; AFOSR-75-1291TR) Avail: NTIS CSCL 09/2

An important component of mechanical theorem proving systems are unification algorithms which find most general substitutions which, when applied to two expressions, make them equivalent. Functions which are associative and commutative (such as the arithmetic addition and multiplication functions) are often the subject of mechanical theorem proving. An algorithm which unifies terms whose function is associative and commutative is presented here. The algorithm eliminates the need for axiomatizing the associativity and commutativity properties and returns a complete set of unifiers without recourse to the indefinite generation of variants and instances of the terms unified required by previous solutions to the problem. GRA

N76-18808# Defence Research Establishment Pacific, Victoria (British Columbia).
AN ADAPTIVE COMPUTER-CONTROLLED DIGITAL FILTER: AN APPLICATION OF THE HEWLETT-PACKARD 5470A FOURIER PROCESSOR
R. F. MacKinnon and J. L. Dorscher Jun. 1975 23 p
(AD-A015942; DREP-TM-75-8) Avail: NTIS CSCL 09/2

One-stage digital filters are described mathematically. An expression for average power gain over a frequency interval is derived. Anti-bias, anti-alias and band-pass filters are presented as examples. Microprograms to implement such filters on a Hewlett-Packard 5470A Fast Fourier Processor are presented together with a timing table. The facility so described enables a user to filter adaptively under computer control. GRA

N76-18809# Defense Supply Agency, Alexandria, Va. Office of the Assistant Director Plans Programs and Systems.
REPORT ON LOGISTICS COMPUTERS POWER SUPPLY
Apr. 1975 69 p
(AD-A015753) Avail: NTIS CSCL 09/2

A study of the electric power being provided to logistics systems computers was made to determine the impact of power fluctuations and power outages on these computer systems. The report contains analyses performed using data pertaining to the power supplies of computers supporting the logistics systems of the Military Services and the Defense Supply Agency. The data used for the analyses was obtained through DoD Component briefings, Component data submissions, and on-site research. Conclusions and recommendations based on these analyses are included in the Report. GRA

N76-18810# Illinois Univ., Urbana. Center for Advanced Computation.
ILLIAC 4 APPLICATIONS RESEARCH Final Semiannual Technical Report, 1 Jul. - 31 Dec. 1974
31 Dec. 1974 48 p refs
(Contract DAHC04-72-C-0001; ARPA Order 1899)
(AD-A016222; UIUC-CAC-DN-177) Avail: NTIS CSCL 09/2

During this period work was performed in the following areas: (1) Development of numerical techniques suitable for parallel processing; (2) ILLIAC IV multispectral image processing; (3) Research in distributed computational systems of heterogeneous computers; (4) Research and development of network access. GRA

N76-18811# Naval Academy, Annapolis, Md.
THE DESIGN AND ANALYSIS OF A GENERALIZED INTERFACE SYSTEM FOR THE PDP-8 COMPUTER
James Allan Phillips 22 May 1975 29 p refs
(AD-A015958; USNA-TSPR-71) Avail: NTIS CSCL 09/2

This report is a design of a generalized interface system between the PDP-8 computer and external hardware devices. The project was initiated while working with the PDP-8 and recognizing that only a small percent of the computers potential was actually available to the user. - The research is divided into two phases: 1. The design of a bootstrap loader to increase the memory capacity of the PDP-8. 2. The practical application of the computer to service many users in a laboratory environment. The final system designs are described in the paper. These two interface designs offer the PDP-8 greater potential in memory capacity and on the other hand users participation. When implemented, these systems will aid the PDP-8 in becoming an invaluable tool in laboratory for research and training assistance. Author (GRA)

N76-18812# New York Univ., N.Y. Computer Research Lab.
DEVELOPMENT OF AN ON-LINE IMAGE SCANNING AND PROCESSING SYSTEM
I. Chakravarty and H. Freeman Jul. 1975 48 p refs
(Grant AF-AFOSR-2755-75; AF Proj. 9769)
(AD-A015919; CRL-40; AFOSR-75-1293TR) Avail: NTIS CSCL 09/2

This report describes the development of an on-line scanning and processing system. The system consists of a modified Litton Model 1120 high-resolution flying spot-scanner, an ADAGE AGT-30 graphics computer, the scanner to computer interface and various display 1/0 devices. The system forms a major component of a laboratory for computer graphics and image processing. The design of the system permits scanning and image processing under interactive control. The report is divided into two parts. The first consists of a description of the hardware and the second, of the software thus far developed for on-line scanning. GRA

N76-18813# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A GRAPH-THEORETIC APPROACH TO CLUSTER ANALYSIS Interim Report
Z. Chen and K. S. Fu Jul. 1975 52 p refs
(Grant AF-AFOSR-2661-74; AF Proj. 9769)
(AD-A015928; AFOSR-75-1430TR) Avail: NTIS CSCL 09/2

The problem of cluster analysis is formulated in the realm of graph theory. A graph-theoretic clustering technique is presented which makes use of the concepts of the connectivity of a graph, the network flow theory, the invariance principle and the k-nearest-neighbor threshold method of edge construction. Several major drawbacks of the existing clustering methods can be overcome by the proposed method. Computer experiments of the application of the method to artificial and real data are reported. GRA

N76-18814# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
A HYBRID COMPUTER OPTIMAL FILTER Interim Report
L. Basanez, P. Brunet, R. S. Bucy, R. Huber, D. S. Miller, and J. Pages 1975 7 p refs
(Grants AF-AFOSR-2141-71; NSF OIP-74-20601; AF Proj. 9769)
(AD-A015853; AFOSR-75-1376TR) Avail: NTIS CSCL 09/2

In 1971 a hybrid computer algorithm for implementation of an optimal nonlinear one-step predictor by applying Bayes: Rule to sequentially update the conditional probability density function from the latest data was presented in a paper. Such a filter has been constructed at the Laboratorio de Automatica at the Universidad Politecnica de Barcelona. This paper contains a description of the hybrid optimal filter as it was actually implemented for the cubed sensor problem. A comparison of the hardware and software architectural features with those proposed in the 1971 paper presented and reasons for differences given. Accuracy of estimates and run times are compared against those predicted in and those of all digital filters performing the same estimation. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-18815 Oklahoma State Univ., Stillwater.
SOME MAXMIN LOCATION AND PATTERN SEPARATION PROBLEMS: THEORY AND ALGORITHMS Ph.D. Thesis
Balakrishnan Dasarathy 1975 255 p

Avail: Univ. Microfilms Order No. 76-3413

A few closely related maxmin nonlinear programming problems that have applications in such diverse areas as location theory, information theory and pattern recognition are examined. One investigation involves the location of a point in a given convex polyhedron which maximizes the minimum Euclidean distance from a given set of m points in the polyhedron. The potential relevance of the maxmin problem under consideration to pattern classification is shown. In particular, algorithms are suggested to generate nearest-neighbor decision surfaces for an arbitrary number of disjoint pattern sets in two and three dimensions as an application of the above maxmin problem. Finally, an extension to the problem in the form of weighted Euclidean distances is considered and it is proved that many of the theorems developed for the unweighted case remain applicable for this extension. Dissert. Abstr.

N76-18816 Oklahoma State Univ., Stillwater.
LANGUAGES FOR SPECIFYING PROTECTION REQUIREMENTS IN DATA BASE SYSTEMS: A SEMANTIC MODEL Ph.D. Thesis
H. Rex Hartson 1975 246 p
Avail: Univ. Microfilms Order No. 76-3444

A model of access control was developed to provide a semantic base for constructs of protection languages at many levels of sophistication, accommodating a wide range of protection policies. The concept of ownership is used for validation of authorizations in the model. Various ownership policies, such as group ownership, subownership, and conditional ownership can be represented. The basic sets of the model are presented and the set of system states is derived from the set of all values of the resources. Subsets of states are defined by restrictions on resource values, described by Boolean expressions known as conditions. The most important use of conditions is as access conditions, which allow each access decision to depend on information related to the user, to resources, to data content, to access history, and to the general state of the system. A GENERAL class of users is defined to establish an overall minimum level of access rights without an explicit representation for each and every user. Dissert. Abstr.

N76-18817 Oklahoma State Univ., Stillwater.
COMPARATIVE STUDIES TOWARDS THE PERFORMANCE EVALUATION OF SOFTWARE FOR SOLVING SYSTEMS OF NONLINEAR EQUATIONS Ph.D. Thesis
Donald Lee Kalmey 1975 207 p
Avail: Univ. Microfilms Order No. 76-3467

The success of algorithms for solving systems of nonlinear equations is very dependent on the nature of the particular system being solved. This research was directed towards parametrizing nonlinear systems of equations so that one could more effectively select which algorithm is best suited for a given system. The parameters investigated included the size of the system, the goodness of the initial approximation, the nonlinearity of the system, and the number of potential nonconvergent regions inherent in the system. Comparative studies were conducted for six different algorithms. These studies showed that the above parameters did influence the efficiency and likelihood of success of each of the algorithms. Based on these comparisons, a use-oriented guideline for the choice of algorithm relative to these parameters was suggested, and a model for comparing algorithms for solving systems of nonlinear equations was developed. Dissert. Abstr.

N76-18818 Minnesota Univ., Minneapolis.
APPROXIMATION ALGORITHMS FOR SOME P-COMPLETE SCHEDULING PROBLEMS Ph.D. Thesis
Chul Eun Kim 1975 110 p
Avail: Univ. Microfilms Order No. 76-4054

Many problems arising in various fields such as graph theory, combinatorics, scheduling and integer linear programming are solvable in polynomial time if and only if P = NP. These computationally related problems form an equivalence class called P-complete problems. The algorithms studied are of polynomial time complexity and generate solutions that are good estimates of the actual solutions. Among the problems considered are the knapsack and sum of subsets problems, scheduling for maximum profit/minimum time, non-identical multiprocessor scheduling and multiprocessor scheduling of tasks with precedence constraints. Dissert. Abstr.

N76-18819 Minnesota Univ., Minneapolis.
DIGITAL FILTERS IN AUTOMATIC RATIONAL FUNCTION APPROXIMATION OF ANALOG SYSTEMS Ph.D. Thesis
William Andrew Plice 1975 272 p
Avail: Univ. Microfilms Order No. 76-4102

Four basic filter building blocks were developed. Any linear analog system may be accurately modeled, for transient as well as steady state signals, using combinations of these basic building blocks. The coefficients of each of the digital filters are explicit functions of the parameters of the S plane representation of their analog equivalents. The S plane representation of an unknown analog system is identified by a model adjusting algorithm which seeks a parameter vector which minimizes the mean square error of model output. The model adjusting algorithm is based upon the iterated least squares method for solution of a system of nonlinear equations. A detailed derivation of the digital filters and of the model adjusting algorithm is presented. The ability of the technique to correctly identify the parameters of unknown analog systems is demonstrated using simulated simple analog systems. Dissert. Abstr.

N76-18820 Iowa Univ., Iowa City.
FINITE ARRAY SCHEMATA Ph.D. Thesis
Dennis Wayne Leinbaugh 1975 163 p
Avail: Univ. Microfilms Order No. 76-2147

Program schemes augmented with variable sized finite arrays were studied. Basic functions and basic predicates used in the schemes are partial mappings. The methods of adding such arrays to program schemes are: (1) finite arrays declared local to blocks; (2) finite arrays allocated explicitly by statements; (3) finite arrays declared local to defined functions or predicates. Recursive and nonrecursive functions or predicates are included with parameter passage using either call by value, value/result, reference, or name. These classes are all compared in power and compared to program schemes augmented with one-way infinite arrays. When each class is augmented with an index equality test, all of the classes are shown (input-output) equivalent, except the class using defined predicates and passage of parameters by value which is shown less powerful. Without the index equality test, each of the finite array classes are shown equivalent, except the finite class using defined predicates and parameter passage by value which is proven less powerful. Dissert. Abstr.

N76-18821*# M&S Computing, Inc., Huntsville, Ala.
LOGSIM PROGRAMMER'S MANUAL
C. L. Mitchell and J. F. Taylor Feb. 1976 103 p
(Contract NAS8-25621)
(NASA-CR-144174; Rept-72-0002) Avail: NTIS HC $5.50 CSCL 09B

A programmer's manual is reported for a Logic Simulator (LOGSIM) computer program that is a large capacity event simulator with the capability to accurately simulate the effects of certain unknown states, rise and fall times, and floating nodes in large scale metal oxide semiconductor logic circuits. A detailed description of the software with flow charts is included within the report. Author

N76-18822*# M&S Computing, Inc., Huntsville, Ala.
MOSS, AN EVALUATION OF SOFTWARE ENGINEERING TECHNIQUES Final Report
J. R. Bounds and J. L. Pruitt 30 Jan. 1976 40 p
(Contract NAS8-31222)
(NASA-CR-144191; Rept-76-0006) Avail: NTIS HC $4.00 CSCL 09B

An evaluation of the software engineering techniques used for the development of a Modular Operating System (MOSS) was described. MOSS is a general purpose real time operating system which was developed for the Concept Verification Test (CVT) program. Each of the software engineering techniques was described and evaluated based on the experience of the MOSS project. Recommendations for the use of these techniques on future software projects were also given. Author

N76-18823*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

A FORTRAN PROGRAM FOR THE ANALYSIS OF LINEAR CONTINUOUS AND SAMPLED-DATA
John W. Edwards Jan. 1976 233 p refs
(NASA-TM-X-56038) Avail: NTIS HC $8.00 CSCL 09B

A FORTRAN digital computer program which performs the general analysis of linearized control systems is described. State variable techniques are used to analyze continuous, discrete, and sampled data systems. Analysis options include the calculation of system eigenvalues, transfer functions, root loci, root contours, frequency responses, power spectra, and transient responses for open- and closed-loop systems. A flexible data input format allows the user to define systems in a variety of representations. Data may be entered by inputing explicit data matrices or matrices constructed in user written subroutines, by specifying transfer function block diagrams, or by using a combination of these methods. Author

N76-18824*# Aeronutronic Ford Corp., Houston, Tex. Space Information Systems Operation.
COMPUTER OUTPUT MICROFILM (FR80) SYSTEMS SOFTWARE DOCUMENTATION, VOLUME 2
28 Nov. 1975 966 p
(Contract NAS9-1261)
(NASA-CR-147419; SISO-TR531-Vol-2; JSC-10012-Vol-2) Avail: NTIS HC $23.75 CSCL 09B

The system consists of a series of programs which convert digital data from magnetic tapes into alpha-numeric characters, graphic plots, and imagery that is recorded on the face of a cathode ray tube. A special camera photographs the face of the tube on microfilm for subsequent display on a film reader. The applicable documents which apply to this system are delineated. The functional relationship between the system software, the standard insert routines, and the applications programs is described; all the applications programs are described in detail. Instructions for locating those documents are presented along with test preparations sheets for all baseline and/or program modification acceptance tests. M.J.S.

N76-18825*# TRW Systems Group, Redondo Beach, Calif. Systems Evaluation Dept.
LEVEL 2 MDAS PROTOTYPE MONITOR PROGRAM DOCUMENT, PART 2
14 Jun. 1974 289 p
(Contract NAS9-13834)
(NASA-CR-147453; TRW-25990-H025-R0-00 - Pt-2) Avail: NTIS HC $9.25 CSCL 09B

Subroutines contained in the monitor are described, at a level such that programmers may become familiar with the design. Techniques used to implement each component are described. Author

N76-18826*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MULTIPLE RATE DIGITAL COMMAND DETECTION SYSTEM WITH RANGE CLEAN-UP CAPABILITY Patent Application
James R. Lesh (JPL) and Stanley A. Butman, inventors (to NASA) (JPL) Filed 17 Feb. 1976 31 p
(Contract NAS7-100)
(NASA-Case-NPO-13753-1; US-Patent-Appl-SN-658449) Avail: NTIS HC $3.50 CSCL 09B

A multirate digital command system is disclosed which uses the composite signal of a micron-type ranging system as a subcarrier to transmit range codes and data from a station to a receiver where the range codes are sequentially phase modulated. A range cleanup loop in a spacecraft locks the phase of a locally generated reference component C(i) to a received ranging component C(i) and retransmits the component to a ground station. When the inverse phase, of a ranging component is received and detected, the cleanup loop is modified to demodulate phase modulated command symbols while continuing tracking the same ranging component C(i). The command symbol rate is coherently related to the ranging signal component bit rate. NASA

N76-18827# California Univ., Berkeley.
HOW FAR SHOULD YOU GO WITH THE LANCZOS PROCESS? Final Report
W. Kahan and B. Parlett Sep. 1975 17 p refs
(Contract N00014-69-A-0200-1017)
(AD-A016294) Avail: NTIS CSCL 12/1

The Lanczos algorithm can be used to approximate both the largest and smallest eigenvalues of a symmetric matrix whose order is so large that similarity transformations are not feasible. The algorithm builds up a tridiagonal matrix row by row and the key question is when to stop. An analysis leads to a stopping criterion which is inspired by a useful error bound on the computed eigenvalues. GRA

N76-18828# Value Engineering Co., West Long Branch, N.J.
MIRACODE TRANSPORTATION PROGRAM Final Report
John H. Waite (Cryptanalytic Computer Sci., Inc.), Sheldon Epstein (Cryptanalytic Computer Sci., Inc.), and Otto Koudelka (Picatinny Arsenal) Sep. 1975 48 p
(Contract DAAK02-73-D-0045; DA Proj. 1E8-65803-M-728)
(AD-A014990; PA-TR-4757) Avail: NTIS CSCL 14/5

This report discusses a computer software package that has been developed by the EDS and R Project for preparing a standard binary coded microfilm for input to a wide variety of computer output microfilm (COM) devices. This software package is currently being tested at Picatinny Arsenal on two different data base applications prior to being released to other Army installations. Author (GRA)

N76-18829# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
PROGRAM DESIGN WITH ABSTRACT DATA TYPES Interim Report
Lawrence Flon Jun. 1975 38 p refs
(Contract F44620-73-C-0074; Grant NSF DCR-74-24573; ARPA Order 2466)
(AD-A015843; AFOSR-75-1295TR) Avail: NTIS CSCL 09/2

This paper explores the use of abstract data types as a modularization and structuring technique in the design of programs, particularly larger programs including compilers and operating systems. The concepts of type and type definition are discussed. Some data structuring mechanisms are generalized and several simple examples are presented. The examples increase in complexity and conclude with the design of a directory system, illustrating the power of data types as a design tool. GRA

N76-18830# Pattern Analysis and Recognition Corp., Rome, N.Y.
STRUCTURED PROGRAMMING EVALUATION Final Technical Report
J. M. Morris, K. N. Klingbail, P. Kang, A. Franklin, and R. Jackson Jul. 1975 128 p refs
(Contract F30602-73-C-0357)
(AD-A015763; PAR-74-25; RADC-TR-75-179) Avail: NTIS CSCL 09/2

This report was prepared as part of a structured programming effort. The first section provides a general introduction to structured programming concepts. It is intended to give some of the background material needed to place the project in an appropriate perspective. The second section describes the Structured Programming Preprocessor (SP3), which performs certain editing, precompiling and diagnostic functions in support of structured programming the PL1 language under the MULTICS Operating System. The third section provides a systemmatic study of programming experience under the constraints of structured programming. Conclusions and recommendations are presented in the fourth section. GRA

N76-18831# University of Southern Calif., Los Angeles. Dept. of Quantitative Business Analysis.
LINEAR PROGRAMMING WITH LINKED LISTS AND AUTOMATIC GUBERIZATION
Richard D. McBride Jul. 1975 29 p refs
(Contract AF-AFOSR-2715-74; AF Proj. 9749)
(AD-A015918; USC-WP-8175; AFOSR-75-1289TR) Avail: NTIS CSCL 12/2

Linked Lists are used to carry the nonzero elements of the basis inverse in the execution of a linear programming algorithm. The number of nonzero elements needed to execute the algorithm can be reduced by: (1) Using the kernel (a submatrix of the basis inverse); (2) Converting the problem to an equivalent generalized GUB problem; (3) Using a new method to carry

range restricted constraints. Computational results indicate that basis inverses are not as dense as commonly assumed; the density is related to the density of the conflict matrix corresponding to the coefficient matrix; the nonzero buildup can be significantly reducing using the method noted above. A comparison of algorithms used to locate disjoint subsets of constraints is made. GRA

N76-18832# Stanford Univ., Calif. Systems Optimization Lab.
APPLICATIONS OF INTERVAL ARITHMETIC IN SIGNOMIAL PROGRAMMING
Louis J. Mancini Aug. 1975 232 p refs
(Contracts N00014-75-C-0865; N00014-75-C-0267; NR Proj. 047-143; NR Proj. 047-064)
(AD-A016218; SU-SOL-75-23) Avail: NTIS CSCL 12/2

Many problems in engineering design can be found formulated as a nonlinear program where a criterion function of the design variables is minimized, or maximized, subject to certain inequality and equality constraints which define the problem. Such a formulation allows the engineer to use optimization theory and numerical algorithms to find the best design, or global solution, among the possibily infinite number of reasible designs. However, optimization methods are guaranteed to yield the global solution only if the nonlinear program has a certain structure; and in many cases only a solution which is guaranteed to be locally optimal can be obtained. The problem of multiple local solutions in nonlinear programs is of major concern to both the engineer and operations researcher. If all the functions in the nonlinear program are sums of power functions, then the nonlinear program is a signomial program. All the methods presented here use interval arithmetic, a generalization of ordinary arithmetic in which the basic elements are closed intervals of the real line. This study brings interval arithmetic and signomial programming together. GRA

N76-18833# Stanford Univ., Calif. Systems Optimization Lab.
AN ACCURACY TEST FOR UPDATING TRIANGULAR FACTORS
J. J. Tomlin Apr. 1975 10 p refs
(Contracts N00014-75-C-0865; DAHC04-74-C-0034)
(AD-A016183; SU-SOL-75-9) Avail: NTIS CSCL 12/2

This note describes a new accuracy test for the Forrest-Tomlin method for updating triangular factors of the basis, based on standard error analysis techniques. This test has proved very useful in practice when the method is applied to digitally unstable models. GRA

N76-18834# Stanford Univ., Calif. Systems Optimization Lab.
ON LARGE-SCALE LINEAR PROGRAMMING
Markku Juhani Kallio Apr. 1975 121 p refs
(Contracts N00014-75-C-0865; AT(04-3)-326; NR Proj. 047-143)
(AD-A016180; SU-SOL-75-7) Avail: NTIS CSCL 12/2

Three classes of methods are proposed for solving large-scale linear programs. First, sequential projection is applied to reformulate the linear program as a dynamic program. Second, the revised simplex method using a special factorization for the basis is considered. Third, a class of feasible direction methods is presented. A comparison of these three classes is made. A probabilistic model is developed to estimate computational effort for matrix multiplications. This model is applied to estimate computational effort for linear programming algorithms. GRA

N76-18835# British Steel Corp., Sheffield (England). Information Services.
A PROGRAM PACKAGE FOR THE STORING, PROCESSING AND PLOTTING OF PLANT TRIAL DATA
G. V. Fairhurst Jun. 1975 34 p refs
(PB-243676/4; GS/TECH/622/1/75/C) Avail: NTIS HC $4.00 CSCL 09B

A comprehensive system for the acquisition of large volumes of plant trial data is reported. This is achieved by the use of small, highly mobile Modulog and Compulog data logging machines. This report describes a computer program DATSTO, written in Basic Plus, to enable the rapid transfer and storage of this data onto disk cassettes. Any data may be stored; however, the current version of the program is specifically designed to handle data of format similar to that adopted for paper tape output from the data logging machines. A sister program DATPLO, has been developed to enable plotting of virtual array scan data stored using DATSTO. GRA

N76-18836# Naval Research Lab., Washington, D.C.
VECTORIZATION OF RECURSION RELATIONS Final Report
Jay P. Boris Oct. 1975 9 p refs Sponsored in part by ERDA
(NRL Proj. H02-37; NRL Proj. H02-39)
(AD-A016582; NRL-MR-3144) Avail: NTIS CSCL 12/1

Techniques for efficient vectorization of a simple recursive relation and a tridiagonal series of equations are presented. Both problems are solved by a folding procedure similar to that used in computing the fast Fourier transform. The tridiagonal algorithm is a generalized form of the cyclic-reduction technique used by Hockney and Buneman. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N76-18837*# Virginia Univ., Charlottesville. Research Labs for the Engineering Sciences.
AN INVESTIGATION OF POTENTIAL APPLICATIONS OF OP-SAPS: OPERATIONAL SAMPLED ANALOG PROCESSORS Semiannual Report
E. A. Parrish and E. S. McVey Feb. 1976 11 p refs
(Grant NsG-1223)
(NASA-CR-143303; EE-4009-102-76) Avail: NTIS HC $3.50 CSCL 09B

The impact of charge-coupled device (CCD) processors on future instrumentation was investigated. The CCD devices studied process sampled analog data and are referred to as OP-SAPS - operational sampled analog processors. Preliminary studies into various architectural configurations for systems composed of OP-SAPS show that they have potential in such diverse applications as pattern recognition and automatic control. It appears probable that OP-SAPS may be used to construct computing structures which can serve as special peripherals to large-scale computer complexes used in real time flight simulation. The research was limited to the following benchmark programs: (1) face recognition, (2) voice command and control, (3) terrain classification, and (4) terrain identification. A small amount of effort was spent on examining a method by which OP-SAPS may be used to decrease the limiting ground sampling distance encountered in remote sensing from satellites. Author

N76-18838# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
ON THE USE OF DISTANCE AND INFORMATION MEASURES IN PATTERN RECOGNITION AND APPLICATIONS
C. H. Chen 1 Aug. 1975 21 p refs
(Grant AF-AFOSR-71-2119D)
(AD-A015799; EE-75-5; AFOSR-75-1237TR) Avail: NTIS CSCL 09/2

In the development of pattern recognition theory during the past few years, there has been active interest in comparing the relative merits of various distance and information measures by evaluating the error bounds. Normally the tighter the error bounds

a distance or information measure can provide, the better features it can select. There are now at least fifteen different measures available. They have two main advantages. (1) They are generally easier to calculate than the error probability itself which normally cannot be computed exactly. These measures can provide good upper and/or lower bounds of the error probability. (2) Features can be selected and ordered to maximize (or in some cases minimize) the measures in order to minimize indirectly the error probability. Linear transformation for dimensionality reduction can also be derived from these measures. This paper is concerned with the theoretical problems and the applications of these measures. GRA

N76-18839# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
SPECTRAL AND SPATIAL ADAPTIVE PROCESSING OF ARRAY DATA Interim Report
C. H. Chen 6 Aug. 1975 19 p refs
(Grant AF-AFOSR-2119-71; AF Proj. 9769)
(AD-A015805; EE-75-6; AFOSR-75-1353TR) Avail: NTIS CSCL 09/4

The first part of this tutorial paper is concerned with the comparative evaluation of signal processing techniques. It is shown that all linear filter (prediction) techniques are highly correlated. Nonlinear signal processing techniques are much needed. The use of maximum entropy method in spectral and spatial processing of the array data is emphasized. Adaptive processing becomes necessary for highly nonstational signals. The second part of the paper deals with the adaptive mean level detector and the use of pattern recognition techniques as an aid to the array data processing. Extensive references are provided in the bibliography section of the paper. GRA

N76-18840# Stanford Univ., Calif. Dept. of Electrical Engineering.
SYSTEM MODELING AND STATISTICAL DATA PROCESSING Interim Report
Thomas Kailath and Thomas Cover 1975 25 p refs
(Contract F44620-74-C-0068; AF Proj. 9749)
(AD-A015933; AFOSR-75-1287TR) Avail: NTIS CSCL 09/4

This report is a brief summary of progress made by the authors and their associates during the period 1 May 1974 through 30 April 1975 in a continuing research project concerned with statistical signal processing. The several research tasks described include (1) scattering theory and least-square estimation, (2) applications of orthogonal polynomials, (3) time-invariant causal implementations of Gaussian signal detectors, (4) fast algorithms for arbitrary processes, (5) square-root algorithms for estimation, (6) extended transfer functions and systems matrices, (7) fast algorithms in speech processing, (8) minimal realization problems, (9) rearest neighbor pattern recognition, (10) Kolmogorov complexity, (11) compound sequential Bayes predictors for sequences with an empirical Markov structure, (12) optimal finite memory learning algorithms for the finite sample problem, (13) measurement selection in the k-hypothesis testing problem, and (14) estimating the entropy of English language text. A list of publications containing the detailed research findings is provided. GRA

N76-18841# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
SINGULAR PERTURBATION FOR NON-LINEAR FILTER DENSITIES M.S. Thesis
Richard Ralph Tye Aug. 1975 74 p refs
(Grant AF-AFOSR-2141-71; AF Proj. 9769)
(AD-A015867; AFOSR-75-1379TR) Avail: NTIS CSCL 09/4

For discrete periodic sensors and multi-dimensional white noise sources, with the source covariance matrix proportional to a scalar source noise parameter = o, the one-step predictor and the filter conditional densities are represented by a power series in the source noise parameter. Let n be an integer and 1/delta be the sampling rate. Then the coefficients of the power series at time n delta are differential operators acting on the conditional filter density at time (n-1) delta. A set of difference equations is derived which relates the jth coefficient of the series at time n delta to the k, k=o, 1, ..., j, coefficients of the series at time (n-1) delta. This difference equation is applied to a phase demodulator sensor with a one-dimensional Brownian motion source. For j=1, the Fourier transform of the difference equation is computed, and is shown to be identical to one obtained for this filtering system by other methods. The difference equation is used to derive a series solution for a phase demodulator which senses the first integral of Brownian motion. A sub-optimal filter is constructed from the Fourier transform of the difference equation. Author (GRA)

N76-18842# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
TRANSITION NETWORK GRAMMARS FOR SYNTACTIC PATTERN RECOGNITION Interim Report
J. M. Chou and K. S. Fu 15 May 1975 10 p refs Presented at the Conf. on Computer Graphics, Pattern Recognition and Data Structure, Los Angeles, 14-16 May 1975
(Grant AF-AFOSR-2661-74; AF Proj. 9769)
(AD-A015929; AFOSR-75-1297TR) Avail: NTIS CSCL 09/2

The application of transition network grammars to syntactic pattern recognition is studied in this paper. The relation between basic transition networks and context-free grammars is demmonstrated. Augmented transition networks can be used to represent context-sensitive, or even type 0 languages. Stochastic transition networks are defined and the parsing of languages represented by transition networks and stochastic transition networks investigated. Error-correcting parsing algorithms are proposed from the viewpoint of syntactic pattern recognition. The voice-chess grammar is used in an experiment to illustrate various parsing results. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-18843 California Univ., San Diego.
ALGEBRAIC STRUCTURES UP TO HOMOTOPY Ph.D. Thesis
Ronald James Williams 1975 67 p
Avail: Univ. Microfilms Order No. 76-2323

An attempt was made to systematize a general approach to algebraic structures on topological spaces. A general definition of a 'pseudo-theory' is proposed, which includes theories, pros, and props (investigated by Boardman and Vogt); the categories delta and gamma (used by Segal); and certain other categories proposed by Anderson for dealing with iterated loop spaces. A general construction called 'homotopy left Kan extension' is explored and used to construct 'free' homotopy algebras for a certain class of pseudo-theories which includes all theories, pros and props as well as delta and gamma. A major result is the theorem: any homotopy tau-algebra is weakly equivalent to a strict tau algebra when tau is a theory. This result is proved with the help of a variation on the homotopy left Kan extension construction. Finally, it is shown that homotopy left Kan extension can be used to construct classifying spaces for iterated loop spaces. Dissert. Abstr.

N76-18844 Yeshiva Univ., New York.
POLYNOMIALS AND HARMONIC FUNCTIONS ON FINITE FIELDS Ph.D. Thesis
Mary Shiffman 1975 123 p
Avail: Univ. Microfilms Order No. 76-4552

The possibility of extending the generalized form of the Lagrange interpolation formula to functions on finite fields was investigated. An interpolation formula was developed for finite field polynomials using a 'derivative' which is defined on these polynomials. Complex valued functions on the finite field are considered, with emphasis on the characters. A series of definitions of harmonic function using a mean value property are given; it is found that, for all practical purposes, the only harmonic functions are the constant ones. These results are extended to the p-adic numbers and the field of formal power series, and theorems analogous to the two radius theorem are proven. Dissert. Abstr.

N76-18845 Ohio State Univ., Columbus.
RECONSTRUCTION PROBLEMS OF GRAPHS AND DESIGNS Ph.D. Thesis

Agnes Hui Chan 1975 141 p
Avail: Univ. Microfilms Order No. 76-3400

The characterization of the linegraph of an affine space and the embedding of the residual designs of a Mobius plane are considered. Dissert. Abstr.

N76-18846 Ohio State Univ., Columbus.
FACTORIZATION OF GRAPHS Ph.D. Thesis
Ronald Dee Baker 1975 90 p
Avail: Univ. Microfilms Order No. 76-3371

A general theory of graph factorizations was developed, unifying ideas from graph theory, design theory, and recreational mathematics. General techniques are developed for demonstrating the existence of special types of factorizations for all or almost all graphs of a particular family. The general techniques are applied to four specific problems. It is shown that Whist tournaments, a type of individual bridge tournament, exist for any number of players divisible by four except possibly 152. It is shown that resolvable balanced incomplete block designs with block size four and index three exist for any number of points divisible by four except possibly 152. It is shown that spouse avoiding mixed doubles round robin tennis tournaments can be constructed for large numbers of couples provided that number is odd or divisible by four. Finally it is shown that nearly Kirkman triple systems exist for all numbers of points larger than twelve and divisible by six, except possibly 84, 102 or 174.
Dissert. Abstr.

N76-18847*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPLICIT APPROXIMATE-FACTORIZATION SCHEMES FOR THE LOW-FREQUENCY TRANSONIC EQUATION
William F. Ballhaus and Joseph L. Steger Nov. 1975 42 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-73082; A-6373) Avail: NTIS HC $4.00 CSCL 12A

Two- and three-level implicit finite-difference algorithms for the low-frequency transonic small disturbance-equation are constructed using approximate factorization techniques. The schemes are unconditionally stable for the model linear problem. For nonlinear mixed flows, the schemes maintain stability by the use of conservatively switched difference operators for which stability is maintained only if shock propagation is restricted to be less than one spatial grid point per time step. The shock-capturing properties of the schemes were studied for various shock motions that might be encountered in problems of engineering interest. Computed results for a model airfoil problem that produces a flow field similar to that about a helicopter rotor in forward flight show the development of a shock wave and its subsequent propagation upstream off the front of the airfoil. Author

N76-18848*# Polytechnic Inst. of New York, Farmingdale.
HIGHER-ORDER NUMERICAL SOLUTIONS USING CUBIC SPLINES Final Report
S. G. Rubin and P. K. Khosla Washington NASA Feb. 1976 61 p refs
(Grant NsG-1091)
(NASA-CR-2653; POLY-AE/AM-75-15) Avail: NTIS HC $4.50 CSCL 12A

A cubic spline collocation procedure was developed for the numerical solution of partial differential equations. This spline procedure is reformulated so that the accuracy of the second-derivative approximation is improved and parallels that previously obtained for lower derivative terms. The final result is a numerical procedure having overall third-order accuracy of a nonuniform mesh. Solutions using both spline procedures, as well as three-point finite difference methods, are presented for several model problems. Author

N76-18849# Hanford Engineering Development Lab., Richland, Wash.
HDES5: A SUBROUTINE TO SOLVE A SYSTEM OF DIFFERENTIAL EQUATIONS
B. C. Gneiting and F. E. Bard 1970 28 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-75-45) Avail: NTIS HC $4.00

The subroutine HDES5 contains a numerical method for solving a system of first-order differential equations. Some features of the HDES5 subroutine are as follows: a fifth order predictor-corrector method is used; it performs very well in comparison with other differential equation system solver subroutines; it is easy to incorporate into large-scale computer programs; it has relatively low core storage requirements; the execution times are low for relatively smooth problems. Author (NSA)

N76-18850# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
DYNAMIC PROGRAMMING WITH NEGATIVE REWARDS AND AVERAGE REWARD CRITERION
Prakash Awate May 1975 143 p refs
(Contracts DAHC04-73-C-0008; N00014-67-A-0077-0020)
(AD-A016636; TR-251) Avail: NTIS CSCL 12/1

Basic results on dynamic programming with finite state and action spaces are generalized to a class of dynamic programming problems that includes most queuing control problems treated in literature. The results establish existence of average reward optimal stationary policies and uniqueness of solution to the functional equation of dynamic programming in the average reward case among nonpositive functions up to an additive constant. The question of convergence of discount optimal policies to average optimal policies is settled in a fairly general setting. Existence of nearly optimal policies is shown in a particular queuing control problem. The principle which turns out to be most useful in the study is a basic probabilistic systems theorem to the effect that a fair game remains fair under transformation by certain systems of optional stopping. Author (GRA)

N76-18851# California Univ., Berkeley. Operations Research Center.
ON THE SOLUTIONS OF THE POSITIVE SEMI-DEFINITE COMPLEMENTARITY PROBLEM
Ilan Adler and David Gale Aug. 1975 17 p refs
(Contract N00014-69-A-0200-1010; Grant NSF MPS-74-21222)
(AD-A016804; ORC-75-12) Avail: NTIS CSCL 12/1

A short direct proof is given of the fact that if a semi-definite complementarity problem is feasible then it is solvable. It is also shown that the set of all complementary solutions of such a problem is a face of the polyhedron of all feasible solutions and an effective procedure for finding all such solutions is given. Author (GRA)

N76-18852# Wisconsin Univ., Madison. Dept. of Computer Sciences.
COLLOCATION METHODS FOR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS IN ONE SPACE DIMENSION
John H. Cerutti and Seymour V. Parter Apr. 1975 31 p refs
(Contract N00014-67-A-0128-0004)
(AD-A016685; TR-247) Avail: NTIS CSCL 12/1

Collocation at Gaussian points for a scalar m'th order ordinary differential equation has been studied by C. de Boor and B. Swartz. J. Douglas, Jr. and T. Dupont, using collocation at Gaussian points, and a combination of energy estimates and approximation theory have given a comprehensive theory for parabolic problems in a single space variable. While the results of this report parallel those of Douglas and Dupont, the approach is basically different. The Laplace transform is used to 'lift' the results of de Boor and Swartz to linear parabolic problems. This indicates a general procedure that may be used to 'lift' schemes for elliptic problems to schemes for parabolic problems. Additionally there is a section on longtime integration and A-stability. GRA

N76-18853# Stanford Univ., Calif. Dept. of Statistics.
DERIVING UNBIASED RISK ESTIMATORS OF MULTINORMAL MATRIX MEAN ESTIMATORS USING ZONAL POLYNOMIALS
James V. Zidek 9 Sep. 1975 33 p refs
(Contract N00014-67-A-0112-0085; NR Proj. 042-267)
(AD-A016597; TR-225) Avail: NTIS CSCL 12/1

Unbiased risk estimators are derived for estimators in certain classes of equivariant estimators of multinormal matrix means, xi. In the case when the covariance structure is known these estimators are based on the sufficient statistic, X, a p x k

matrix whose elements are normally distributed and for which E(X) = xi. In cases where the covariance is unknown, it is assumed that there is available independently observed data from which the covariance may be estimated. The method is a multivariate version of that introduced by James and Stein (1960) in establishing the worth of their estimator. The multivariate version uses known zonal polynomial expansions for the distributions of noncentral statistics to achieve the required generalization of the Pitman-Robbins (1949) representation of a noncentral chi-squared statistic. GRA

N76-18854# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
SOME RESULTS USEFUL FOR BOUNDING THE GLOBAL MINIMUM OF A FUNCTION
Louis J. Mancini and Garth P. McCormick 3 Jul. 1975 11 p refs
(Contract AF-AFOSR-2504-73)
(AD-A015922; Serial-T-317; AFOSR-75-1264TR) Avail: NTIS CSCL 12/2

Conditions are given which are sufficient to prove the existence of a unique unconstrained minimizer in a convex compact set. An exact formula is given for the amount by which a value of the function exceeds its global minimum. GRA

N76-18855# Cornell Univ., Ithaca, N.Y. Dept. of Computer Science.
THE COMPLEXITY OF THE QUATERNION PRODUCT
Thomas D. Howell and Jean-Claude Lafon Jun. 1975 26 p refs
(Contract N00014-67-A-0077-0021)
(AD-A013505; CU-CSD-75-245) Avail: NTIS CSCL 12/1

Let X and Y be two quaternions over an arbitrary ring. Eight multiplications are necessary and sufficient for computing the product XY. If the ring is assumed to be commutative, at least seven multiplications are still necessary and eight are sufficient. Author (GRA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-18856 Minnesota Univ., Minneapolis.
ON FINDING APPROXIMATE SOLUTIONS TO SOME PROBLEMS Ph.D. Thesis
Teofilo Francisco Gonzalez-Arce 1975 143 p
Avail: Univ. Microfilms Order No. 76-4046

Efficient approximation algorithms for statistical tests, graph partition and job sequencing were obtained. These polynomial time bounded algorithms guarantee approximate solutions that are within a certain percentage of the true optimal solution value. The specific problems studied are: the k-Max-Cut; Kolmogorov-Smirnov and Lilliefors tests; and scheduling on uniform processor systems, open shops, flow shops and job shops. For preemptive scheduling disciplines it is shown that the flow shop and job shop problems are P-complete. For other problems it is shown that finding a good approximation algorithm is as hard as finding a good algorithm for the optimal solution; the approximation problem is also P-complete. Some problems with this property are: the travelling salesperson, cycle covers, 0-1 integer programming, multicommodity network flows, quadratic assignment, general partition, k-MinCluster and generalized assignment. Dissert. Abstr.

N76-18857 Iowa Univ., Iowa City.
MODELING AND GENERATING STOCHASTIC INPUTS FOR SIMULATION STUDIES Ph.D. Thesis
Pandu Ranga Rao Tadikamalla 1975 158 p
Avail: Univ. Microfilms Order No. 76-2192

Some methods for modeling and generating univariate stochastic inputs are given. Two levels of knowledge of the investigator are considered with regard to these stochastic inputs: (1) the probability distribution is known and (2) the probability distribution is unknown. For case 1, some exact and approximate methods are given for generating random variates from specified continuous distributions with particular attention given to the gamma distribution. Two of the approximate methods are based on the Weibull distribution and the Burr distribution. For case 2, where the distribution is unknown, systems of distributions are considered, including the Pearson, the Johnson, the Burr and the Ramberg-Schmeiser systems. Although the Ramberg-Schmeiser system has certain advantages over the other systems for simulation applications, a disadvantage is the difficulty in estimating its parameters. In addition, a percentiles method and a least squares method based on percentiles are described and computer programs are given for using these methods to fit this system to a set of data. Dissert. Abstr.

N76-18858 Illinois Univ., Chicago.
ON STOCHASTIC GAMES WITH LIMITING AVERAGE PAYOFF Ph.D. Thesis
Martin Alan Stern 1975 65 p
Avail: Univ. Microfilms Order No. 76-2288

Noncooperative stochastic games with finite state and action spaces in which the payoffs are of the limiting average type are considered. Some conditions are given which guarantee the existence of stationary optimal strategies for the two players. Games in which the transition probabilities are functions of the actions of only one of the players are also studied. It is shown that when such games are also zero-sum, both players possess semi-Markov optimal strategies. Finally, an example is given in which both players have optimal strategies but in which neither player has a stationary optimal strategy. Dissert. Abstr.

N76-18859 Bowling Green State Univ., Ohio.
STOCHASTIC PROCESSES WITH INDEPENDENT INCREMENTS TAKING VALUES IN A HILBERT SPACE Ph.D. Thesis
Jeffrey Lynn Spielman 1975 60 p
Avail: Univ. Microfilms Order No. 76-2771

The decomposition of a continuous stochastic process into a uniformly convergent sum of independent processes was investigated and was shown to hold true when the process is separable and takes values in a real, separable Hilbert space. Utilizing this main result as a tool, it was possible to exhibit some properties of the stochastic process that rely upon it: (1) a Levy-Khintchine representation of the characteristic functional of the process follows directly from its decompositon, (2) a representation theorem in which the discontinuous parts of the process may be represented by means of a certain stochastic integral, (3) the proof of the main result is much easier when the process has a finite variance. Author

N76-18860 Bowling Green State Univ., Ohio.
APPLICATIONS OF EXTREME POINT METHODS TO PROBABILITY THEORY Ph.D. Thesis
Thomas Alfonso OConnor 1975 77 p
Avail: Univ. Microfilms Order No. 76-2763

Extreme point methods and their applications to probability theory were explored. Most of this work was concerned with extending Johansen's work to include n-dimensional infinitely divisible characteristic functions. If one is to follow the ingenious methods of Johansen, one has to know solutions of various functional equations in this more general setting. In the final section, Khinchine's representation of unimodal distributions through the use of extreme points was derived. Dissert. Abstr.

N76-18861*# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Electrical and Systems Engineering.
COMPUTATION OF OUTPUT FEEDBACK GAINS FOR LINEAR STOCHASTIC SYSTEMS USING THE ZANGNILL-POWELL METHOD
Howard Kaufman [1975] 15 p refs
(Grant NsG-1188)
(NASA-CR-146308) Avail: NTIS HC $3.50 CSCL 12A

Because conventional optimal linear regulator theory results in a controller which requires the capability of measuring and/or estimating the entire state vector, it is of interest to consider procedures for computing controls which are restricted to be linear feedback functions of a lower dimensional output vector and which take into account the presence of measurement noise and process uncertainty. To this effect a stochastic linear model has been developed that accounts for process parameter and

initial uncertainty, measurement noise, and a restricted number of measurable outputs. Optimization with respect to the corresponding output feedback gains was then performed for both finite and infinite time performance indices without gradient computation by using Zangwill's modification of a procedure originally proposed by Powell. Results using a seventh order process show the proposed procedures to be very effective.
Author

N76-18862# Technology, Inc., Dayton, Ohio.
ON THE DISTRIBUTION OF THE LIKELIHOOD RATIO TEST STATISTIC FOR COMPOUND SYMMETRY Technical Interim Report
T. C. Chang, P. R. Krishnaiah, and J. C. Lee Jun. 1975 23 p refs
(Contract F33615-73-C-4155)
(AD-A015048; ARL-75-0166) Avail: NTIS CSCL 12/1

In this paper the authors approximated the distribution of the likelihood ratio test statistic for compound symmetry with a suitable Pearson type distribution. Using this approximation, percentage points of the above likelihood ratio statistic are constructed. The accuracy of the approximation used is sufficient for practical purposes. The usefulness of these tables is illustrated with some data on frostbite experiments conducted by the USAF School of Aviation Medicine. GRA

N76-18863# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
A SEQUENTIAL GOODNESS-OF-FIT TEST FOR COMPOSITE HYPOTHESES INVOLVING UNKNOWN SCALE AND LOCATION PARAMETERS
Richard David Gelber Aug. 1975 144 p refs
(Contracts DAHC04-73-C-0008; N00014-67-A-0077-0020)
(AD-A016637; TR-266) Avail: NTIS CSCL 12/2

A sequential test was developed of the composite goodness-of-fit hypothesis for families of distribution with unknown and unspecified scale and location parameters. The test represents a generalization of a procedure for sequentially testing the simple goodness-of-fit wherein both the form and the parameters of the hypothesized distribution are completely specified. At each state of experimentation, a statistic is computed which has certain known properties under the given null hypothesis and different known properties under a given alternative. A sequential test was constructed using the probability ratio of this statistic under the null hypothesis and the alternative in a Wald sequential probability ratio test. Estimators of the scale and location parameters of the hypothesized distribution were also constructed at each stage. Author (GRA)

N76-18864# University of Southern Calif., Los Angeles. Social Science Research Inst.
MISAGGREGATION EXPLAINS CONSERVATIVE INFERENCE ABOUT NORMALLY DISTRIBUTED POPULATIONS
Gloria E. Wheeler and Ward Edwards 1 Aug. 1975 42 p refs
(Contract N00014-75-C-0487; ARPA Order 2105)
(AD-A016829; USC-001597-5-T; SSRI-RR-75-11) Avail: NTIS CSCL 12/1

Three major hypotheses have been proposed to account for conservative inference: misaggregation, misperception, and response bias. The research reported in this paper allowed the testing of these hypotheses. Subjects made probabilistic judgments about stimuli generated from normally distributed populations.
GRA

N76-18865# Stanford Univ., Calif. Dept. of Statistics.
EDF STATISTICS FOR TESTING FOR THE GAMMA DISTRIBUTION WITH APPLICATION TO TESTING FOR EQUAL VARIANCES
M. A. Stephens 2 Sep. 1975 23 p refs
(Contract N00014-67-A-0112-0085; NR Proj. 042-267)
(AD-A016596; TR-224) Avail: NTIS CSCL 12/1

Asymptotic percentage points are given for statistics W(2), U(2), and A(2), calculated from the empirical distribution function (EDF) of random variables z sub i. The z sub i were obtained from random variables x sub i by (z sub i) = (theta prime) (x sub i) where theta prime is an appropriate estimator of an unknown theta. The EDF statistics were used to test that theta x is gamma distributed. An application is given to testing for homogeneity of variances. Author (GRA)

N76-18866# Stanford Univ., Calif. Dept. of Statistics.
BAYES LINEAR ESTIMATORS OF THE INTENSITY FUNCTION OF THE NONSTATIONARY POISSON PROCESS
M. Lawrence Clevenson and James V. Zidek 4 Aug. 1975 33 p refs
(Contract N00014-67-A-0112-0085; NR Proj. 042-267)
(AD-A016594; TR-222) Avail: NTIS CSCL 12/1

This paper gives and compares in a numerical example several estimators of the intensity function of a nonstationary Poisson process. GRA

N76-18867# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
ON THE ESSENTIAL QUADRATIC NATURE OF LQG CONTROL-PERFORMANCE MEASURE CUMULANTS Interim Report
S. R. Liberty and R. C. Hartwig Aug. 1975 42 p refs
(Contracts N00014-73-A-0434-0002; N00014-75-C-0779; Grants NSF GK-32704; NSF GK-13618; RR0210501)
(AD-A016852) Avail: NTIS CSCL 12/1

An in depth look at a complete statistical description of linear-quadratic-Gaussian (LQG) performance measures is presented in this paper. The development leads to computationally tractable formulae that form the basis for design performance analysis. The complete statistical description of performance developed here exhibits the essential quadratic nature of the LQG class of systems. GRA

N76-18868# Florida State Univ., Tallahassee. Dept. of Statistics.
INCONSISTENCY OF MAXIMUM LIKELIHOOD ESTIMATOR OF DISTRIBUTIONS HAVING INCREASING FAILURE RATE AVERAGE
F. Proschan and A. W. Marshall Sep. 1975 13 p refs Prepared in cooperation with British Columbia Univ.
(Grants AF-AFOSR-2581-74; NSF MPS-74-15239)
(AD-A015911; FSU-Statistics-M350) Avail: NTIS CSCL 12/1

Marshall and Proschan showed that the MLE for a life distribution with increasing failure rate is strongly consistent (Ann. Math. Statist., 1965, 36, 69-77). In this note the author shows that the MLE for a life distribution with increasing failure rate average is not consistent; in fact, maximum likelihood estimation in the IFRA case yields estimators of the average failure rate and of the distribution function which, in general, coverage a.s. to values other than the true values. In the decreasing failure rate average case, the MLE fails to exist. GRA

N76-18869# Stanford Univ., Calif. Dept. of Operations Research.
MARKOV DECISION PROBLEMS WITH EXPECTED UTILITY CRITERIA
David M. Kreps 1 Jun. 1975 106 p refs
(Contracts N00014-75-C-0493; N00014-75-C-0521; Grants NSF MPS-74-23693; NSF ENG-74-12378; NR Proj. 042-064; NR Proj. 042-065)
(AD-A016233; SU-TR-29) Avail: NTIS CSCL 12/2

Finite state and action Markov decision problems with expected utility criteria are analyzed. A Markov decision chain (or sequential decision process) is defined in the usual manner. But instead of seeking to maximize the expected sum (or product) of rewards, the objective is maximization of the expectation of some cardinal utility function defined on the sequence of rewards. Author (GRA)

N76-18870# Stanford Univ., Calif. Dept. of Operations Research.
MARKOV DECISION PROBLEMS WITH EXPECTED UTILITY CRITERIA
David M. Kreps 1 Jun. 1975 106 p refs
(Contracts N00014-75-C-0521; N00014-75-C-0493; Grants NSF MPS-74-23693; NSF ENG-74-12378; NR Proj. 042-265)
(AD-A016235; SU-TR-36) Avail: NTIS CSCL 12/2

Finite state and action Markov decision problems with expected utility criteria are analyzed. A Markov decision chain (or sequential decision process) is defined in the usual manner.

But instead of seeking to maximize the expected sum (or product) of rewards, the objective is maximization of the expectation of some cardinal utility function defined on the sequence of rewards. The standard notions and results of infinite horizon problems with additive utility are extended to the case of general utility. Appropriate optimality equations, conserving strategies, policy iteration and value iteration concepts are given. Analogues of negative, positive, convergent and transient dynamic programming are defined and the standard results proven; e.g., conserving strategies are optimal in the cases analogous to negative, convergent and transient dynamic programming. Because utility functions are not generally separable, optimal strategies must take into account more than just the current state. But generalizations of memoryless and stationary strategies are given, and conditions are established under which there exists an optimal memoryless/stationary strategy. The basic notion is summarized utility; rewards up to every decision epoch are summarized (with 'sufficient' richness) in a single number. GRA

N76-18871# Stanford Univ., Calif. Systems Optimization Lab.
PARAMETRIC TECHNIQUES FOR MULTISTAGE STOCHASTIC ALLOCATION
Robert E. Doherty Aug. 1975 259 p refs
(Contracts N00014-75-C-0267; AT(04-3)-326; Grant NSF MPS-71-03341-A03; NR Proj. 047-064)
(AD-A016188; SU-SOL-75-19) Avail: NTIS CSCL 12/2

This paper treats a problem of multistage allocation under conditions of risk. After qualitative features of the problem are discussed, an efficiency procedure is formulated and is shown to have desirable computational, utility-theoretic, and asymptotic properties. Several techniques are then developed which are applicable to an approximation of the efficient frontier by parametric complementary pivoting. These include a parametric algorithm for a minimax approximation, some parametric decomposition methods, and an interactive algorithm for certain problems with a block-angular structure. A listing for a FORTRAN 4 code solving the parametric linear complementarity problem is given in an appendix. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-18872 Wisconsin Univ., Madison.
A GENERAL STRUCTURE FOR A RESOURCE MANAGEMENT IN A COMPUTER NETWORK Ph.D. Thesis
George Cowan, Jr. 1975 164 p
Avail: Univ. Microfilms Order No. 75-23838

The effective management of computer system resources is examined. It is particularly concerned with those problems which arise from the lack of adaptability to user-defined management goals. The delineation of the responsibility for both the design and delegation of resource management will provide the user community significantly greater freedom to manage resources to meet their goals while preserving required system properties. Design constraints and a system design are derived for factoring responsibilities which may be delegated with commensurate authorities, to appropriate levels of management. The system design is developed in the very general environment of a machine independent network of virtual systems. Dissert. Abstr.

N76-18873 Oklahoma Univ., Norman.
A TWO-LEVEL HIERARCHICAL CONTROL SYSTEM FOR A DISTRIBUTED NETWORK OF COMPUTERS Ph.D. Thesis
Judith A. Edwards 1975 180 p
Avail: Univ. Microfilms Order No. 76-3093

Control theory principles were successfully used to determine operating policies for a variety of industrial processes. Hierarchical control methods offer the advantage of an adaptive system which is modeled by a top-down, modular approach. A two-level hierarchical system containing reconfiguration and local scheduling is demonstrated for a distributed network of computers connected by a common bus. The performance index on the optimizing level, reconfiguration, is to minimize the bus traffic by assigning the interacting programs to processors within the physical constraints of the processors and the constraints of an on-line, real-time system. The methods of quadratic binary programming and cluster analysis are compared for the suitability to compute real-time configurations. The local scheduling of periodic messages and programs to minimize the number of missed deadlines is considered for the direct control level. Dissert. Abstr.

N76-18874# California Univ., Berkeley. Operations Research Center.
STRUCTURE, EVALUATION, AND CONTROL OF DECISION ACTIVITY NETWORKS
Klaus Neumann Jul. 1975 49 p refs
(Contract N00014-69-A-0200-1010; NR Proj. 047-033)
(AD-A016621; ORC-75-11) Avail: NTIS CSCL 12/2

A new approach for handling special decision networks is presented. This approach also allows for optimally controlling the corresponding projects. Decision networks are activity networks with several kinds of nodes, and with each arc is associated the probability that the corresponding activity is performed, and the duration of the activity, a nonnegative random variable. Three possible entrance sides (and, exclusive-or, inclusive-or) and two exit sides (deterministic, stochastic) of a node and hence six different node types are considered satisfying a so-called 'node logic'. GRA

N76-18875# Dikewood Corp., Albuquerque, N.Mex.
COMPUTER-BASED SYSTEM FOR CONTROL AND DISSEMINATION OF ROUTINE MANAGEMENT ACTIONS AND NOTICES Final Report
B. G. VanBlaricum Oct. 1975 49 p refs
(Contract F29601-74-C-0022)
(AD-A016775; DC-TR-1242-13; AFSWC-TR-75-4) Avail: NTIS CSCL 05/1

To curtail the inevitability of 'losing' any of the multitudinous assignments which must be accomplished in the course of fulfilling an overall mission, a formalized method of communication, as well as an established record-keeping facility, are enabled in the computer-based system for control and dissemination of management actions and general information notices. Those assignments are routed from and to the relevant sub-groups with a summary capability for use of top management. Incorporation of this management vehicle resulted in the successful intercommunication and cross-correlation of the huge array of tasks associated with the operation of a multi-staffed management organization. GRA

N76-18876# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
BOUNDS ON THE SPEED-UP OF PARALLEL EVALUATION OF RECURRENCES
L. Hyafil and H. T. Kung Sep. 1975 21 p refs
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A016227) Avail: NTIS CSCL 09/2

To understand the performance of parallel computers such as ILLIAC IV and C.mmp, the largest speed-up that can be obtained for a given task must be known. If there are k processors, the largest speed-up that can be achieved is k and the authors call this optimal speed-up. The speed-ups in general depend on the parallel decomposition of a particular computing task and the various aspects of the multiprocessing system, including memory contention, process communication, operating system overhead, etc. In this paper, the authors concentrate on the issue of decomposing tasks, and assume that the multiprocessing system is idealized so that it causes no delays at all. It is shown that even under this idealized assumption, there are problems for which, because the parallel decompositions are inherently difficult, the optimal speed-up cannot be achieved. GRA

N76-18877# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
MINIMAX MULTIFACILITY LOCATION WITH EUCLIDEAN DISTANCES (REVISED)
Jack Elzinga (Johns Hopkins Univ.), Donald Hearn, and William D. Randolph (Decisions and Design, Inc.) Jun. 1975 27 p refs

(Grants DA-ARO(D)-31-124-75-G149; NSF ENG-74-22159)
(AD-A015806; RR-75-4-Rev; ARO-10841.1-M-Rev) Avail: NTIS CSCL 12/2

The problem considered is that of locating N new facilities among M existing facilities with the objective of minimizing the maximum weighted Euclidean distance among all facilities. The application of nonlinear duality results show that this problem can always be solved by maximizing a continuously differentiable concave objective subject to a small number of linear constraints. This leads to a solution procedure which produces very good numerical results. Computational results are reported. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-18878 Minnesota Univ., Minneapolis.
TOPOLOGICAL AND MEASURE-THEORETIC PROPERTIES OF COMPACT TRANSFORMATION GROUPS WITH FREE ACTION Ph.D. Thesis
Russell Allan Johnson 1975 141 p
Avail: Univ. Microfilms Order No. 76-4053

Transformation groups (G,X) and bitransformation groups (G,X,T) are discussed where G is a compact Hausdorff group, T is any group, and X is a compact Hausdorff space. It is assumed that G acts freely: this condition is satisfied if (G,X,T) is minimal distal. Dissert. Abstr.

N76-18879 Oklahoma Univ., Norman.
INVESTIGATION OF A GAUGE THEORY IN GENERAL RELATIVITY Ph.D. Thesis
Larry Gene Stephenson 1975 103 p
Avail: Univ. Microfilms Order No. 76-3134

The proposition was studied that a physical theory which prescribes a metric via a set of field equations is incomplete unless there is some prescription as to how lengths and times at different events are to be compared. It is assumed that Einstein's field equations hold in a gauge other than the customary one. Several equations for this gauge are proposed and by coupling these gauge equations with the field equations several problems in relativity and cosmology were investigated. In two of the problems investigated in relativity, the gravitational shift in spectra lines and radar echo delay, it is shown that this noncustomary gauge theory yields results which are sensibly different than those obtained from the ordinary Einstein theory. One model in cosmology (a static noncustomary universe) was investigated, and it is shown for this case that the noncustomary gauge theory predicts results which are compatible with observed phenomena. Dissert. Abstr.

N76-18880 Texas A&M Univ., College Station.
ON EINSTEIN VACUUM FIELDS ADMITTING A QUADRATIC KILLING TENSOR WITH NORMAL PRINCIPAL CONGRUENCES Ph.D. Thesis
Franklin George Shin 1975 36 p
Avail: Univ. Microfilms Order No. 76-3672

The case in which the eigenvectors determined by the Killing tensor are distinct and hypersurface orthogonal was investigated. The integrability conditions of the Killing equations were obtained. The vacuum field equations and the Bianchi identities are then shown to split, under fairly general restrictions, the metric tensor into functions of a single variable. Dissert. Abstr.

N76-18881# National Aerospace Lab., Tokyo (Japan). Computer Center.
DIFFERENCE APPROXIMATION OF CAUCHY PROBLEMS FOR QUASI-DISSIPATIVE OPERATORS AND GENERATION OF SEMIGROUPS OF NONLINEAR CONTRACTIONS
Tadayasu Takahashi Jul. 1975 16 p refs
(NAL-TR-419T) Avail: NTIS HC $3.50

The convergence problem of the difference approximation of Cauchy problems formulated for quasi-dissipative operators in a general Banach space was studied. The conditions under which the difference approximation is convergent to the original Cauchy problem was determined. It was found that those conditions are also necessary for the convergence and therefore may be the best possible. In addition, using the result of the convergence of the difference approximation, semigroups of nonlinear contractions were constructed. The sufficient condition treated here generalizes most of the known conditions for the generation of semigroups of nonlinear contractions and admits some local conditions. Author

N76-18882*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONJUGATE QUASILINEAR DIRICHLET AND NEUMANN PROBLEMS AND A POSTERIORI ERROR BOUNDS
John E. Lavery Washington Mar. 1976 18 p refs
(NASA-TN-D-8193; G-7616) Avail: NTIS HC $3.50 CSCL 12A

Quasilinear Dirichlet and Neumann problems on a rectangle D with boundary D prime are considered. Using these concepts, conjugate problems, that is, a pair of one Dirichlet and one Neumann problem, the minima of the energies of which add to zero, are introduced. From the concept of conjugate problems, two-sided bounds for the energy of the exact solution of any given Dirichlet or Neumann problem are constructed. These two-sided bounds for the energy at the exact solution are in turn used to obtain a posteriori error bounds for the norm of the difference of the approximate and exact solutions of the problem. These bounds do not involve the unknown exact solution and are easily constructed numerically. Author

N76-18883# Wisconsin Univ., Madison. Mathematics Research Center.
ANALYSIS OF A DEGREE COMPATIBILITY TEST FOR POLYNOMIAL IRREDUCIBILITY Technical Summary Report
David R. Musser May 1975 39 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GJ-30125)
(AD-A016100; MRC-TSR-1507) Avail: NTIS CSCL 12/1

Polynomials with integer coefficients can often be proved irreducible considering the degrees of factors obtained modulo several different primes. An algorithm based on this idea is presented and the number of primes, N, required are analyzed. The results show that mean (N) grows very slowly with n and is less than 5 for all n less than or equal to 200. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-18884# California Inst. of Tech., Pasadena. Dept. of Applied Mathematics.
NONLINEAR PROBLEMS IN CONTINUUM MECHANICS Final Report, 1 Sep. 1967 - 31 Dec. 1974
H. B. Keller 19 Sep. 1975 8 p refs
(Contract DAHC04-68-C-0006)
(AD-A016173; ARO-7625.37-M) Avail: NTIS CSCL 20/11

The main areas of mathematical study included: nonlinear eigenvalue problems for ordinary and partial differential equations, bifurcation theory of stationary and time dependent processes, iterative methods for nonlinear equilibrium problems, numerical methods for two point boundary value problems, numerical methods for nonlinear diffusive systems. Some of the physical problems treated concerned: buckling of plates and shells, spontaneous combustion, tubular, batch and pellet chemical reactors, biochemical diffusion processes, laminar and turbulent boundary layer flows and nuclear reactors. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-18885*# Pennsylvania State Univ., University Park. Graduate School.
A THEORETICAL AND EXPERIMENTAL STUDY OF ACOUSTIC PROPAGATION IN MULTISECTIONED CIRCULAR DUCTS Ph.D. Thesis
Barry R. Wyerman Mar. 1976 183 p refs
(Grant NGR-39-009-121)
(NASA-CR-146426) Avail: NTIS HC $7.50 CSCL 20A

The propagation of plane waves and higher order acoustic modes in a circular multisectioned duct was studied. A unique source array consisting of two concentric rings of sources, providing phase and amplitude control in the radial, as well as circumferential direction, was developed to generate plane waves and both spinning and nonspinning higher order modes. Measurements of attenuation and radial mode shapes were taken with finite length liners inserted between the hard wall sections of an anechoically terminated duct. Materials tested as liners included a glass fiber material and both sintered fiber metals and perforated sheet metals with a honeycomb backing. The fundamental acoustic properties of these materials were studied with emphasis on the attenuation of sound by the liners and the determination of local versus extended reaction behavior for the boundary condition. A search technique was developed to find the complex eigenvalues for a liner under the assumption of a locally reacting boundary condition. Author

N76-18886*# National Aeronautics and Space Administration. Pasadena Office, Calif.
ACOUSTIC ENERGY SHAPING Patent Application
Taylor G. Wang (JPL) and Daniel D. Elleman, inventors (to NASA) (JPL) Filed 13 Feb. 1976 10 p
(Contract NAS7-100)
(NASA-Case-NPO-13802-1; US-Patent-Appl-SN-658133) Avail: NTIS HC $3.50 CSCL 20A

A suspended mass is shaped by melting all or a selected portion of the mass and applying acoustic energy in varying amounts to different portions of the mass. In one technique for forming an optical waveguide slug, a mass of oval section is suspended and only a portion along the middle of the cross-section is heated to a largely fluid consistency. Acoustic energy is applied to opposite edges of the oval mass to press the unheated opposite edge portions together so as to form bulges at the middle of the mass. In another technique for forming a ribbon of silicon for constructing solar cells, a cylindrical thread of silicon is drawn from a molten mass of silicon, and acoustic energy is applied to opposite sides of the molten thread to flatten it into a ribbon. NASA

N76-18887*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE SUPPRESSION BY AN ACOUSTICALLY TREATED THREE-RING INLET ON A TF-34 ENGINE
Gene L. Minner, Richard G. Goldman, and Laurence J. Heidelberg Washington Mar. 1976 37 p refs
(NASA-TM-X-3366; E-8524) Avail: NTIS HC $4.00 CSCL 21E

Acoustic performance tests were conducted with a three-ring inlet noise suppressor designed for a TF-34 engine. For all tests the aft noise sources were highly suppressed. The measured inlet suppression was large, reaching levels greater than 30 db at the peak. Comparisons of the data and the performance predictions were in reasonably good agreement. The frequency of peak attenuation was well predicted; the magnitude and spectral shape were reasonably well predicted. Agreement was best when the distribution of sound energy across the inlet was taken into account in the performance predictions. Tests in which the length of treatment was varied showed an orderly progression of attenuation with length; performance predictions for the different lengths also showed an orderly progression with length. At the highest speed of the engine, multiple pure tones were present throughout the spectrum in the source noise signature. These tones were effectively suppressed by the inlet liner, even at low frequencies, although the liner was designed to work best at the blade-passing frequency. Author

N76-18888*# General Electric Co., Schenectady, N.Y.
EXPERIMENTAL AND THEORETICAL STUDIES OF SUBSONIC FAN NOISE Final Report
R. Mani and K. Berkofske Washington NASA Mar. 1976 72 p refs
(Contract NAS3-17853)
(NASA-CR-2660) Avail: NTIS HC $4.50 CSCL 20A

The noise generated by inlet turbulence impinging on a subsonic axial flow fan was studied as a function of tip speed, flow coefficient, and intensity and scale of turbulence was carried out. Both turbulence and far field acoustic measurements were made. The new elements introduced in the theoretical analysis were accounting for blade loading dependent noise mechanisms and consideration of anisotropic turbulence impinging on the rotor because of inlet flow contraction effects. Experimentally an unexplained increase of noise at about 1/2 and 1 1/2 times blade passsing frequency was observed at low flow coefficients even though there was no evidence of compressor surge. In the final version the theory does a fair job of predicting variations of noise with blade loading and tip speed. Alteration of inlet turbulence length scales produced some but not very pronounced changes in the far field PWL spectra. Some degree of eddy contraction and resulting anisotropy were essential to explain the concentration of energy around blade passing frequencies. Author

N76-18889*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPUTER PROGRAM TO PREDICT ROTOR ROTATIONAL NOISE OF A STATIONARY ROTOR FROM BLADE LOADING COEFFICIENT
Ramani Ramakrishnan (George Washington Univ.), Donald Randall (Computer Sci. Corp.), and Robert N. Hosier Washington Feb. 1976 164 p refs
(NASA-TM-X-3281; L-9796) Avail: NTIS HC $6.75 CSCL 20A

The programing language used is FORTRAN IV. A description of all main and subprograms is provided so that any user possessing a FORTRAN compiler and random access capability can adapt the program to his facility. Rotor blade surface-pressure spectra can be used by the program to calculate: (1) blade station loading spectra, (2) chordwise and/or spanwise integrated blade-loading spectra, and (3) far-field rotational noise spectra. Any of five standard inline functions describing the chordwise distribution of the blade loading can be chosen in order to study parametrically the acoustic predictions. The program output consists of both printed and graphic descriptions of the blade-loading coefficient spectra and far-field acoustic spectrum. The results may also be written on binary file for future processing. Examples of the application of the program along with a description of the rotational noise prediction theory on which the program is based are also provided. Author

N76-18890# Washington Univ., Seattle. Applied Physics Lab.
A SIMPLIFIED MODEL OF THE SPECTRAL CHARACTERISTICS OF HIGH FREQUENCY SURFACE SCATTER Final Technical Report
Robert L. Swarts and Christian J. Eggen 20 Aug. 1975 26 p refs
(Contract N00014-75-C-1010; NR Proj. 004-105)
(AD-A015709; APL-UW-7512) Avail: NTIS CSCL 20/1

Classical wave theoretical treatments can be used to predict the general characteristics of the acoustic field scattered from a roughened time-varying sea surface. Various approximations can then be invoked to handle the so-called slightly rough and very rough surface cases. In this paper an expression for the spectrum of the scattered sound is derived for the very rough case in terms of specific surface wave parameters. This expression is then evaluated for several surface spectra, including the fully aroused Neuman-Pierson and Pierson-Moskowitz surface wave spectra. Finally, these results for special cases of the Neuman-Pierson spectra are compared with those obtained by numerically integrating the general form for the same spectra, a technique that does not involve the very rough case approximation. GRA

N76-18891# School of Aerospace Medicine, Brooks AFB, Tex.
A-WEIGHTED SOUND LEVELS IN COCKPITS OF FIXED - AND ROTARY-WING AIRCRAFT Progress Report, Dec. 1972 - Dec. 1974

Donald C. Gasaway Aug. 1975 27 p refs
(AF Proj. 7755)
(AD-A015735; SAM-TR-75-22) Avail: NTIS CSCL 20/1

Noise measurements obtained within the cockpits of 339 fixed- and rotary-wing aircraft during normal cruise are reported. The sample includes 271 fixed-wing and 68 rotary-wing aircraft that are grouped according to type and number of power plants. Mean A-weighted levels ranged from 92 to 105 db for fixed-wing vehicles and from 98 to 106 db for helicopters. Means and standard deviations are reported by octave-bands, all-pass (flat), A-levels, and preferred speech interference levels (PSIL, average of 500, 1000 and 2000 Hz). Also, at-the-ear A-levels are reported for generalized amounts of attenuation provided by headsets commonly worn in aircraft. Author (GRA)

N76-18892# Tennessee Univ., Knoxville. Ultrasonics Lab.
AMPLITUDE AND PHASE OF RAYLEIGH-ANGLE REFLECTIONS OF GAUSSIAN ULTRASONIC BEAMS INCIDENT ON LIQIUD/SOLID INTERFACES
Gerald W. Scott Sep. 1975 115 p refs
(Contract N00014-71-A-0121-0001; NR Proj. 384-306)
(AD-A016024; TR-13) Avail: NTIS CSCL 20/1

The reflected field generated by a bounded ultrasonic beam incident from a liquid onto the plane surface of a solid at the Rayleigh angle was measured with an immersible acoustic goniometer. Incident beams with Gaussian amplitude profiles were generated by apodizing the electric field across the transmitting crystal with a metal-strip electrode behind the crystal. The incident beams were characterized by optical and acoustical measurements. Amplitude and phase were measured in reflections from interfaces between water and aluminum, water and aluminum oxide, and water and stainless steel. The goniometer translated the receiver along a plane perpendicular to the direction of wave propagation, allowing point-by-point measurement across the width of the field. Field amplitude was measured as voltage developed across the receiver crystal; relative phase was measured by synchronizing the receiver ososcilloscope with the transmitted pulse and recording changes in the delay of the received pulse. Some major features in the measured-amplitude profiles resemble features that Bertoni and Tamir illustrate in their solutions. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-18893 Nebraska Univ., Lincoln.
ABSOLUTE DIFFERENTIAL CROSS SECTIONS FOR 20 TO 800 eV ELECTRON ARGON AND ELECTRON MOLECULAR NITROGEN COLLISIONS FOR ELASTIC SCATTERING AND SECONDARY ELECTRON PRODUCTION Ph.D. Thesis
Robert Dean DuBois 1975 173 p
Avail: Univ. Microfilms Order No. 76-2016

Cross sections, differential in angle, were measured using electron beams produced by a rotatable electron gun. The beams interacted with static gas targets. Scattered electrons were energy analyzed by a parallel plate spectrometer with an energy resolution of 0.35% and angular acceptance of approximately 1/2 deg and then counted by a channeltron electron multiplier. By measuring all of the physical quantities involved and calibrating the efficiency of the counting system, absolute cross sections were obtained that are independent of any other experiment. Elastic cross sections, differential in angle, were measured for 20 to 800 eV electrons elastically scattered from argon atoms and nitrogen molecules. Scattering angles ranged from 2 to 153 deg. Dissert. Abstr.

N76-18894*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MOLECULAR CONTAMINATION STUDY BY INTERACTION OF A MOLECULAR BEAM WITH A PLATINUM SURFACE
Hubert E. Nuss Jan. 1976 39 p refs
(NASA-TM-X-58169; JSC-09951) Avail: NTIS HC $4.00 CSCL 20L

The capability of molecular beam scattering from a solid surface is analyzed for identification of molecular contamination of the surface. The design and setup of the molecular beam source and the measuring setup for the application of a phase sensitive measuring technique for the determination of the scattered beam intensity are described. The scattering distributions of helium and nitrogen molecular beams interacting with a platinum surface were measured for different amounts of contamination from diffusion pump oil for surface temperatures ranging from 30 to 400 C. The results indicate the scattering of molecular beams from a platinum surface is a very sensitive method for detecting surface contamination. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-18895 Wisconsin Univ., Madison.
SEMICLASSICAL APPROXIMATIONS FOR HIGH ENERGY SCATTERING Ph.D. Thesis
Morris Mitchell Waldrop, Jr. 1975 164 p
Avail: Univ. Microfilms Order No. 75-19100

The insights that classical, point particle dynamics give us about quantum mechanics and quantum field theory are explored. Schwinger's functional techniques in quantum field theory, nonrelativistic semiclassical approximation, development of a simple semiclassical approximation to the Dirac equation in an external electromagnetic field, and the development of a perturbation theory for the semiclassical approximation were looked at. It was also discovered that the semiclassical theory provides some insight into the convergence of the Born series. Some of the difficiencies of the method are disussed and methods for overcoming them are suggested. Dissert. Abstr.

N76-18896 North Texas State Univ., Denton.
CALCULATIONS OF NUCLEAR ENERGIES USING THE ENERGY DENSITY FORMALISM Ph.D. Thesis
William Wei-Ta Pu 1975 85 p
Avail: Univ. Microfilms Order No. 76-4415

The energy density formalism (EDF) was used to investigate two problems. The EDF is a phenomenological method that incorporates as much knowledge of infinite nuclear matter as possible. In this formalism the energy of the nucleus is expressed as a functional of its density. The nucleus energy was obtained by minimizing the functional with respect to the density. The first problem has to do with the stability of nucleus having shapes of different degrees of central depression (bubble shapes). The second problem concerns an anomaly detected experimentally in the isotope shift of mercury. It is concluded that a central depression in the lighter mercury isotopes does not appear to be a possible explanation for the isotope shift anomaly. The anomaly remains unresolved. Dissert. Abstr.

N76-18897# Maryland Univ., College Park. Center for Theoretical Physics.
COVARIANT HARMONIC OSCILLATORS AND EXCITED BARYON DECAYS
Y. S. Kim and Marilyn E. Noz (New York Univ. Med. Center) Nov. 1975 14 p refs
(TR-76-067; Physics-Publ-76-107) Avail: NTIS HC $3.50

The covariant harmonic oscillator wave functions were used to study the decay matrix elements of the excited baryonic resonances. It is pointed out that the harmonic oscillator wave function is suitable for the description of relativistic extended particles. The probability concept of the covariant harmonic oscillator wave functions and the covariant Dirac spinsors were used to calculate the delta hyperon - pion decays of the F15(1690), D15(1690) and D13(1520) resonances. Numerical results are in excellent agreement with the measurable ratios in these decay processes. Author

N76-18898# Maryland Univ., College Park. Center for Theoretical Physics.
COVARIANT HARMONIC OSCILLATORS AND THE PARTON PICTURE
Y. S. Kim and Marilyn E. Noz (New York Univ. Med. Center) Jan. 1976 6 p refs
(TR-76-088; Physics-Paper-76-159) Avail: NTIS HC $3.50

It is shown that the covariant harmonic oscillator wave function exhibits the peculiarities of the Feynman parton picture in the infinite-momentum frame. Author

N76-18899# Tokyo Univ. of Education (Japan). Dept. of Physics.
NONLEPTONIC DECAYS OF CHARMED BARYONS IN THE QUARK MODEL
Yoshinobu Takaiwa, Toshiyuki Minamikawa, and Kimio Miura (Nippon Med. School, Kawasaki, Japan) 1976 22 p refs
(TUETP-75-20) Avail: NTIS HC $3.50

Nonleptonic decays of charmed baryons are discussed in the SU(8) direct product SU(3) color quark model. The weak interaction isospin = 1/2 rule of hyperon decays is explained by 15 and 20" dominance and charned baryon decays occur through 20" dominantly. Also X particles of cosmic ray events are identified with charmed baryons or mesons, respectively, according to their lifetimes, and the charmed baryons are assigned to A1(+) (cnp) and A2(o) (cn lambda), 3rd conjugate of C = 1/2(+) baryons. Author

N76-18900# California Univ., Berkeley. Lawrence Berkeley Lab.
MULTI-WIRE CHAMBER SYSTEM FOR HEAVY ION BEAM MONITORING AT THE BEVALAC
J. Cuperus and R. Morgado Mar. 1975 6 p refs Presented at the Particle Accelerator Conf., Washington, D. C., 12 Mar. 1975
(Contract W-7405-eng-48)
(LBL-3364; Conf-750335-26) Avail: NTIS HC $4.00

Horizontal and vertical integrated beamcurrent profiles are generated by a system of multiwire chambers operating in either the ionization or proportional mode. Sixteen distinct displays are digitally stored and any four may be simultaneously displayed. A new display can be generated at 64 ms intervals. A central control unit selects the mode of operation, the amount of delay after an appropriate trigger, the chamber integration time, and the particular chambers to be displayed. Operating in the proportional mode, the system can detect relativistic heavy-ion beam intensities as low as 10000 charges sq cm/per sec.
Author (NSA)

N76-18901# Brookhaven National Lab., Upton, N.Y.
ISA INJECTION
A. VanSteenbergen 2 Jul. 1975 27 p refs Sponsored by ERDA
(BNL-20252) Avail: NTIS HC $4.50

The conceptual design of the ISA beam injection system is presented together with the relevant AGS-ISA beam transfer parameters. Steering onto the ISA injection orbit is done by means of a shuttlerless 'split pole' vertical deflecting fast dipole. Consideration is given to the tolerable magnitude of the injection kicker stray field at the edge of the high density part of the beam stack. The ISA aperture parameters are detailed and a maximum beam periphery profile (dump profile) is defined within the aperture boundary of the superconducting ring magnet system. Author (NSA)

N76-18902# California Univ., Berkeley. Lawrence Berkeley Lab.
DESIGN OF THE ESCAR INJECTION BEAM LINE
J. Tanabe, J. Staples, and R. Yourd 12 Mar. 1975 4 p refs Presented at the Particle Accelerator Conf., Washington, D. C., 12 Mar. 1975
(Contract W-7405-eng-48)
(LBL-3376; Conf-750335-71) Avail: NTIS HC $4.00

The design features of the elements of the ESCAR (Experimental Superconducting Accelerator Ring) injection beam line are described. The junction of the proton transport system with the ESCAR injection straight section requires the design of mechanical elements compatible with the 10 to the -11th power torr vacuum requirements of the main ring. These elements include a novel septum magnet whose salient design features include a current-carrying septum of tapered thicknesses to reduce the overall power requirements and total enclosure of the magnet coil in a metal can for vacuum compatibility. Other elements are a wire electro-static septum and several fast-rise bump magnets. A transition cryopump is designed to separate the main ring vacuum from the relatively poor 0.000001 torr vacuum of the conventional beam transport line. A brief description of the conventional beam transport line from the 50 MeV proton linac, recently installed for Bevatron injection, is also included. Author (NSA)

N76-18903# Brookhaven National Lab., Upton, N.Y.
PROPOSAL FOR AN ACCELERATOR-BASED NEUTRON GENERATOR
P. Grand, ed. Jul. 1975 160 p refs Sponsored by ERDA
(BNL-20159) Avail: NTIS HC $11.00

An Accelerator-based Neutron Generator is described that consists of a 30-MeV deuteron linear accelerator using a flowing liquid lithium target. With a continuous deuteron current of 100 milliamperes, a source intensity of more than 10 to the 16th neutrons per second will be produced. The neutrons will be emitted in a roughly collimated beam. The proposed facility can be divided into two areas: (1) the 30-MeV linear accelerator and (2) the multiple-target experimental area. Beam power will be 3.0 megawatts; total power will be 4.5 megawatts. The injectors for the linear accelerator will be two 500-kV dc accelerators, one for injection of D+ ions and the other D- ions. They can be used simultaneously or one can serve as a spare in case of breakdown or maintenance of the other. NSA

N76-18904*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
PAYLOAD DOSE RATE FROM DIRECT BEAM RADIATION AND EXHAUST GAS FISSION PRODUCTS
M. A. Capo and R. Mickle [1975] 8 p Sponsored in part by ERDA
(NASA-CR-146438; WANL-TME-005) Avail: NTIS HC $4.00 CSCL 21F

A study was made to determine the dose rate at the payload position in the NERVA System (1) due to direct beam radiation and (2) due to the possible effect of fission products contained in the exhaust gases for various amounts of hydrogen propellant in the tank. Results indicate that the gamma radiation is more significant than the neutron flux. Under different assumptions the gamma contribution from the exhaust gases was 10 to 25 percent of total gamma flux. NSA

N76-18905# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
HIGH TEMPERATURE FUEL IRRADIATION BEHAVIOR EXPERIMENTS: CAPSULE SERIES WANL-TT
M. Tobin and W. Allen 29 May 1963 28 p Sponsored by ERDA
(WANL-TME-375) Avail: NTIS HC $4.50

A series of six capsule irradiation experiments is presented which evaluated the macro and microstructural changes that occured in the fuel during high temperature irradiation. The thermal conductivity and thermal stress resistance were measured for the fuel during irradiation. The principal variable for the fuel is fuel loading and fuel structure. The general sequence of the experimental work was: (1) pre-irradiation evaluation of the fuel, including its microstructure; (2) irradiation at three increasing temperatures up to 2400 C during which temperature and temperature gradient data was taken; (3) hot-cell disassembly of the stainless steel capsule; (4) shipment of the graphite cartridge containing the fuel pellets to WTR Hot-Cell, and (5) examination for changes in the fuel dimensions. Author (NSA)

N76-18906# Battelle Pacific Northwest Labs., Richland, Wash.
CHIMERA OF NEW NUCLEAR MATERIALS
S. H. Bush 1975 67 p refs Presented at the Ann. Conf. of the Am. Soc. for Eng. Educ., Ft. Collins, Colo., 16-19 Jun. 1975 Sponsored by ERDA
(BNWL-SA-5440; Conf-750644-4) Avail: NTIS HC $4.50

The current and future needs in materials for light water reactors and liquid metal fast breeder reactors are reviewed. Information and discussions are included on boiling water reactors, pressurized water reactors, liquid metal fast breeder reactors, corrosion of piping systems and steam generators, ferritic steels,

stainless steels, Inconel 600, pressure vessels, and radiation damage. NSA

N76-18907# Naval Research Lab., Washington, D.C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Semiannual Progress Report, 1 Feb. - 31 Jul. 1975
Lendell E. Steele Aug. 1975 62 p refs
(NRL Proj. M01-14; RR0221141)
(AD-A015619; NRL-MR-3110) Avail: NTIS CSCL 18/10

This report, covering research for the period, 1 February to 31 July 1975, includes: (1) the effect of hold time on fatigue crack propagation in neutron irradiated Type 316 stainless steel; (2) the simulation of irradiation-induced creep in nickel; (3) the elastic plastic toughness of Type 316 stainless steel forging; (4) swelling in dilute binary alloys; and (5) the influence of delta ferrite content on notch toughness of austenitic stainless steel weldments. GRA

N76-18908# Stanford Univ., Calif. Systems Optimization Lab.
NUCLEAR FUEL REPROCESSING EXPANSION STRATEGIES
James M. Gallagher May 1975 239 p refs
(Contract N00014-75-C-0865; NR Proj. 047-143)
(AD-A016185; SU-SOL-75-11) Avail: NTIS CSCL 18/10

This report describes an interdisciplinary effort to apply the techniques of operations research and energy system modeling to a problem of concern to the nuclear-electric power system, namely, determination of cost-effective strategies for capacity expansion of the domestic nuclear fuel reprocessing industry for the 1975-2000 time period. The research also determines cost disadvantages associated with alternative strategies which may be attractive for political, social, or ecological reasons. The sensitivity of results to changes in cost assumptions is investigated at some length. GRA

N76-18909# Naval Research Lab., Washington, D.C.
COLLECTIVE ION ACCELERATION IN A CONVERGING WAVEGUIDE
P. Sprangle, W. M. Manheimer, and A. T. Drobot (Sci. Appl., Inc., McLean, Va.) Oct. 1975 17 p refs
(NRL Proj. R08-69; RR0110941)
(AD-A015940; NRL-MR-3138) Avail: NTIS CSCL 20/7

An ion acceleration mechanism is proposed in which ions are trapped and accelerated by a negative energy space charge wave. Under certain conditions, an electron beam propagating down a slowly converging metal guide can be accelerated. A low phase velocity space charge wave initiated at the large radius end of the guide, because it is supported by the beam, will also accelerate. By trapping ions in the potential wells of a low phase velocity negative energy wave, ion acceleration down the converging drift tube, can be achieved. The ion acceleration leads to the growth in amplitude of the negative energy space charged wave, thus maintaining the trapping. GRA

N76-18910# Austin Research Associates, Inc., Tex.
PRELIMINARY DESIGN PARAMETERS FOR THE AUTO-RESONANT ACCELERATION OF PROTONS UTILIZING THE FX-25 OR FX-100 ELECTRON BEAM SOURCES Final Report, May - Dec. 1974
William E. Drummond, George I. Bourianoff, David E. Hasti, William W. Riestra, and M. L. Sloan Kirtland AFB, N. Mex. AFWL Aug. 1975 73 p
(Contract F29601-74-C-0079)
(AD-A015896; ARA-166; I-ARA-74-U-187; AFWL-TR-74-343) Avail: NTIS CSCL 20/7

Auto-resonant acceleration is a collective acceleration scheme using the lower branch of the electron cyclotron eigenmode of a relativistic electron beam propagating along a magnetic guide field in a conducting cylinder to trap and accelerate ions. The theory of Auto-resonant acceleration is discussed and constraints imposed upon the e-beam, guide field, geometry of the conducting cylinder, and resulting ion beam are derived. These are then used to develop preliminary design criteria for Auto-resonant accelerators using the FX-25 and FX-100 as electron beam sources. GRA

74 OPTICS

Includes light phenomena.

N76-18911 British Broadcasting Corp., Kingswood (England). Research Dept.
THE FILTERING OF LUMINANCE AND CHROMINANCE SIGNALS TO AVOID CROSS-COLOUR IN A PAL COLOUR SYSTEM
J. O. Drewery Dec. 1975 39 p refs
(BBC-RD-1975/36) Avail: BBC, Kingswood Warren, Tadworth, Surrey, Engl.

The origins of cross-color within the PAL system were examined with the aid of one, two and three-dimensional models. Analysis shows where the luminance and chrominance energy is concentrated assuming normal scene content. Filters were developed which restrict the luminance and chrominance energies to distinctly separate regions so minimizing cross-color. These filters range from the simplest to the most complex forms and the degradations so introduced are discussed. Elimination of cross-color is only obtained at the expense of losing spatial or temporal resolution. The conclusion is reached that with the most complex forms of processing a resolution considerably better than that at present can be achieved with no cross-color. Author

N76-18912 British Broadcasting Corp., Kingswood (England). Research Dept.
SOME ASPECTS OF THE USE OF METAL-HALIDE DISCHARGE LAMPS FOR FILM LIGHTING
E. W. Taylor Jan. 1976 19 p refs
(BBC-RD-1976/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The cyclic variations of film exposure, which can occur when discharge lamps run from an alternating supply are used for film lighting, are examined. Supply-frequency limits (of the order of 50 Hz) within which the fluctuations of displayed picture luminance resulting from the film exposure variations are imperceptible, are derived for a particular metal-halide discharge lamp. The effect of camera shutter angle on these limits is described. Approximations arising from the method used to derive the limits are also discussed. Some relationships, based on the assumption that the variation in lamp intensity is sinusoidal in character, are derived. Author

N76-18913* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPARATUS FOR SIMULATING OPTICAL TRANSMISSION LINKS Patent
Michael W. Fitzmaurice and Mona Tycz, inventors (to NASA) Issued 10 Feb. 1976 7 p Filed 25 Jun. 1974 Supersedes N74-30532 (12 - 20, p 2385)
(NASA-Case-GSC-11877-1; US-Patent-3,937,945; US-Patent-Appl-SN-482953; US-Patent-Class-235-184; US-Patent-Class-250-199) Avail: US Patent Office CSCL 20F

A space-to-space or space-to-earth optical transmission link is simulated by positioning a linear optical modulator between an optical carrier source and a receiver for the carrier. The optical modulator is driven by an analog signal having random variations indicative of characteristics of the transmission link, as derived from an analog computer circuit. The analog computer circuit is responsive to a Gaussian random analog source. For space-to-space transmission, transmitter pointing jitter is a dominant noise source and is simulated by deriving a beta statistical variation from the analog computer. For space-to-earth transmission, atmospheric scintillation is a dominant noise source and is simulated by driving the modulator with one of (1) a log normal, (2) Rayleigh, or (3) Ricean output of the analog computer circuit. Official Gazette of the U.S. Patent Office

N76-18914# Defence Research Establishment Valcartier (Quebec).
PROBABILITY DISTRIBUTION AND ASYMPTOTIC VARIANCE OF STRONG IRRADIANCE FLUCTUATIONS OF OPTICAL WAVES IN TURBULENT MEDIA
L. R. Bissonnette Oct. 1975 19 p refs
(Proj. 97-01-38)

(DREV-4042/75; CRDV-4042/75) Avail: NTIS HC $3.50

The asymptotic solutions for the first-and second-order statistical moments of the amplitude of a plane optical wave propagating in a turbulent atmosphere were derived from Maxwell's equations. These solutions show that the irradiance variance would diverge to infinity if the probability distribution were log-normal but that it would tend to unify if the distribution were normal. Therefore, the widely used hypothesis of log-normal probability distribution is incompatible with the experimental observation of the saturation of the irradiance variance. An order of magnitude estimate of the propagation distance characteristic of these asymptotic solutions indicates that they should apply in the saturation region. Author

N76-18915*# Chicago Univ., Ill. Enrico Fermi Inst.
A SENSITIVE FAR INFRARED DETECTION SYSTEM Semiannual Progress Report, 1 Dec. 1974 - 1 Jun. 1975
Roger H. Hildebrand 1 Jun. 1975 35 p refs
(Grant NsG-2057)
(NASA-CR-146345) Avail: NTIS HC $4.00 CSCL 20F

An infrared field optics system was designed which achieves the maximum flux concentration allowed by the Abbe sine inequality and provides efficient coupling to bolometer-type detectors. Author

N76-18916*# College of William and Mary, Williamsburg, Va.
CONSTRUCTION OF PROTOTYPES OF A NEW CLASS OF INFRARED DETECTORS Final Report
Arden Sher 10 Mar. 1976 15 p refs
(Grant NsG-1173)
(NASA-CR-146428) Avail: NTIS HC $3.50 CSCL 20F

A class of infrared detectors is proposed and experimental results are presented for a prototype device. The material used is LaF3, an ionic conductor with a capacitance that varies exponentially with temperature. The detectivity of a prototype detector is estimated from measured signal voltages and incident power, and a Johnson noise voltage calculated from the measured resistance. For the parameters characterizing this device the estimated detectivity is consistent with a theoretical prediction. The theory further predicts an optimum detectivity for much thinner devices than the prototypes. Author

N76-18917*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPTICAL CONVERSION METHOD Patent Application
William E. Perry, inventor (to NASA) Filed 21 Jan. 1976 15 p
(NASA-Case-MSC-12618-1; US-Patent-Appl-SN-651007) Avail: NTIS HC $3.50 CSCL 20F

A method for converting an optical system is described which employs an electrooptic device in conjunction with a pair of crossed polarizing devices between an activated mode and a deactivated mode. The optical system may be used as a neutral density filter, a selective color filter, or a light shutter, as applied to a television camera. The electrooptic device and the polarizing analyzer are fixed with respect to the television camera, and the first polarizing device is selectively positioned in, or removed from, the optical path of the optical system to activate or deactivate it. Where the optical system is used as a selective color filter to produce light beams of alternating colors in a field sequential color television system, deactivation of the optical system renders the television a black-and-white system. NASA

N76-18918# Washington Univ., Seattle. Dept. of Electrical Engineering.
LASER WAVEGUIDE TRANSITION COUPLING STRUCTURE FABRICATION Task Progress Report, 3 Sep. 1974 - 3 Mar. 1975
Roger L. K. Matsumoto and Gordon L. Mitchell 30 Apr. 1975 51 p refs
(Contract N00123-73-C-1200)
(AD-A015318) Avail: NTIS CSCL 20/6

This report describes the techniques used to fabricate transition structures for coupling heterojunction lasers to II-VI waveguides. The process uses a local heat source to round the core of a rectangular dielectric waveguide producing a smooth transition from a rectangular crossection matching the 1 x 20 micrometer laser output to a round crossection similar to a diffused waveguide. When it is rounded, the transition retains the rectangular guide area, e.g., 1 x 20 micrometers, will round to 5 micrometers. If a smaller diameter is desired, the transition can be tapered during the rounding operation. Total transition loss from scattering, absorption and radiation is typically 1 db. GRA

N76-18919# United Technologies Research Center, East Hartford, Conn.
INFRARED WAVEGUIDE MODULATORS AT MICROWAVE FREQUENCIES Semiannual Technical Report, 25 Mar. - 25 Sep. 1975
P. K. Cheo, M. Gilden, and R. Wagner 30 Sep. 1975 43 p refs
(Contract N00014-73-C-0087; ARPA Order 1860)
(AD-A015674; UTRC/R75-922241-1; SATR-6) Avail: NTIS CSCL 20/6

The long-range objective of this program is to develop an efficient and reliable ultra-wideband waveguide modulator for CO2 lasers that will be useful for high resolution, imaging optical radars and high-data-rate optical communication systems. Efficiency and reliability are obtainable by using integrated optics technology. During the reporting period (April 1975 to September 1975), major objectives are: (1) to develop techniques that will improve the quality and strength of the infrared waveguide structure, (2) to establish the relative advantages of grating and prism couplers, and (3) to establish the microwave characteristics of microstrip modulator configuration. These developments are essential for the generation of the predictable level of sideband power at 16 GHz. GRA

N76-18920# Sperry Univac, St. Paul, Minn. Defense Systems Div.
STRIPE DOMAIN LIGHT DEFLECTOR Final Report
D. L. Fleming, T. R. Johansen, F. G. Hewitt, and E. J. Torok 30 Jul. 1975 84 p refs
(Contract N00014-73-C-0308)
(AD-A016048) Avail: NTIS CSCL 20/6

A fast two dimensional solid-state light deflector with a very large number of resolvable spots is needed. It is critical not only for optical memories but also for displays, communication beam steerers, optical radar, optical processors and a host of other devices. The stripe domain light deflector is the newest type of light deflector; it is a solid state, fast, is random accessed in two dimensions, has wide temperature margins, has low power requirements, and has the potential of offering two orders of magnitude more resolvable spots than any other type of solid state deflector. This final report describes work carried out to develop and evaluate the prospects of using materials such as bismuth doped yttrium iron garnet (Bi: YIG) and iron chromium trihalides as stripe domain light deflector elements. GRA

N76-18921# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
HYBRID WAVEGUIDES AND HETERODYNE DETECTORS INTEGRATED OPTICS FOR 10 MICRON WAVELENGTHS Final Technical Report, 15 Feb. 1973 - 30 Nov. 1974
D. B. Anderson, R. R. August, J. T. Boyd, R. L. Davis, and J. D. McMullen 28 Feb. 1975 88 p refs
(Contract N00014-73-C-0297)
(AD-A016258; C73-291.12/501) Avail: NTIS CSCL 20/6

The infrared integrated optics technology for use in the ten micrometer region of the spectrum has been developed as reported herein, comprising a traveling-wave photoconductive heterodyne detector as may be applied to CO2 laser receiver systems. The effort reported herein specifically addresses extrinsic photoconduction in gold-doped, antimony-compensated germanium at 77K in a rectangular waveguide structure and using a gallium-arsenide substrate. A traveling-wave structure is employed wherein the input infrared waveguide is phase matched with the output electrical signal transmission line which also serves as the bias electrodes. Both the slot and strip configuration of the output signal transmission line were investigated. An analysis of the traveling-wave heterodyne detector structure includes the waveguides and phase matching; carrier excitation, lifetime, and diffusion; and detector operation and performance. The analysis of the traveling-wave structure shows that its intrinsic circuit bandwidth extends through the microwave range. GRA

N76-18922# Avco-Everett Research Lab., Everett, Mass.
TURBULENCE CHARACTERIZATION AND CONTROL Technical Report, 1 Aug. 1974 - 31 Jan. 1975
M. G. Miller and P. F. Kellen Jul. 1975 42 p refs
(Contract F30602-75-C-0012; ARPA Order 2646)
(AD-A015759) Avail: NTIS CSCL 20/6

This report covers investigations of atmospheric turbulence effects related to optical imaging. Three specific subjects are discussed. The first is the initial seeing survey carried out in 1962-63 at the ARPA Maui Observation Station (AMOS) on the summit of Haleakala, Maui, Hawaii. These measurements involved the visual observation of planetary features using a 12.5 inch Newtonian reflector. It was concluded that the presence and/or operation of the observatory has disturbed the excellent natural seeing characteristics which may have existed at the site. In order to provide additional information on this subject the authors carried out a series of measurements of the differential angle of arrival variance at AMOS during August 1974. Stellar sources, a seven inch telescope and a Hartmann test procedure were used to collect the data. The final subject is a study of local turbulence control practices used by the astronomical community. GRA

N76-18923# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
RESOLUTION ENHANCEMENT OF DISCRETE OPTICAL SENSORS Final Report
E. S. McVey and K. C. Henderson Sep. 1975 24 p refs Sponsored by AF
(AF Proj. 9769)
(AD-A015910; AFOSR-75-1421TR) Avail: NTIS CSCL 09/2

The approach to the solution of the problem followed in this research has been to trade incremental motion of the sensor array or image and gray level information for increased resolution of black and white (two-level) images. Many techniques have been proposed for resolution enhancement by improving images corrupted by additive noise. However, a technique developed jointly by one of the authors makes it possible to resolve bits of information in the image space which are smaller in area than the area of the sensors in the array. The technique developed is an extension of the above technique which eliminates the requirement for known boundary conditions, and it extends the applicability to a more general class of problems. This enhancement technique is naturally divided into three functional areas. The first is a novel sensing arrangement first proposed by McRee and one of the authors. The second natural division of the process is the quantization of the samples. The third natural division of the process is the estimation of the state of the resolution elements based upon the quantized values of the samples and upon the known sample positions. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-18924 California Univ., Los Angeles.
SURFACE MAGNETO-PLASMA WAVES IN FERROMAGNETIC METALS Ph.D. Thesis
Patrick Eugene Ferguson 1975 150 p
Avail: Univ. Microfilms Order No. 76-3069

The inducement of surface magnetoplasma waves in ferromagnetic nickel and their effect upon the transverse Kerr magnetooptic effect is investigated. Nickel was vacuum deposited as a thin film on the base of a half-cylinder glass prism. An optical beam incident at various angles of incidence induced surface mangetoplasma waves at the nickel-air interface in the presence of total internal reflection. Under these conditions, the ordinary metallic reflectivity and the transverse Kerr magnetooptic effect was measured for a thin film at five angles of incidence over the optical range of 0.36 to 0.60 microns and for a thick nickel film at two angles of incidence over the same optical range for comparison. The magnetooptical constants were calculated from the experimental results for the thick film. Dissert. Abstr.

N76-18925 Wisconsin Univ., Madison.
ANALYSIS OF ION ENERGY DISTRIBUTIONS IN THE LEVITATED TOROIDAL OCTUPOLE Ph.D. Thesis
Robert Alvin Breun 1975 275 p
Avail: Univ. Microfilms Order No. 75-23833

A discrepancy between the zeroth moment of ion distribution functions measured by the magnetic extraction-electrostatic energy analyzer method and total density measurements from a microwave Fabry-Perot interferometer is described. By a process of elimination, electrostatic effects at the entrance aperture of the extractor were found to be the cause. A model was formulated that describes some of the major features of this effect. Experimentally, this discrepancy did not involve major energy dependent distortions in the distribution function for ion energies above four electron volts. Dissert. Abstr.

N76-18926 North Carolina State Univ., Raleigh.
A TWO-DIMENSIONAL MODEL OF A FREELY EXPANDING PLASMA Ph.D. Thesis
Qutubuddin Khalid 1975 73 p
Avail: Univ. Microfilms Order No. 76-2436

The free expansion of an initially confined plasma was studied by the computer experiment technique. In the two-dimensional rod model, the plasma particles, electrons and ions are modeled as infinitely long line charges or rods. The line charges move freely in two dimensions normal to their parallel axes, subject only to a self-consistent electric field. Two approximations, the grid approximation and the periodic boundary condition were made in order to reduce the computation time. Comparison is made with previous calculations of one-dimensional models which employed plane, spherical or cylindrical sheets as charged particles. In order to analyze the effect of the grid approximation, the model is solved for two different grid sizes and for each grid size the plasma dynamics is determined. For the initial phase of expansion the agreement for the two grid sizes is found to be good. Dissert. Abstr.

N76-18927 Iowa Univ., Iowa City.
GUIDING-CENTER PLASMAS AND INVISCID NAVIER-STOKES FLUIDS IN TWO DIMENSIONS Ph.D. Thesis
Charles Eugene Seyler, Jr. 1975 143 p
Avail: Univ. Microfilms Order No. 76-2176

The equilibrium properties of a two-dimensional plasma were examined theoretically within the framework of the random phase approximation. Using a judicious treatment of periodic boundary conditions, extensive thermodynamic functions are found. When restricted to the guiding-center plasma, the results predict a negative temperature threshold energy and give an explicit analytical form for the structure function. When these results are compared to the predictions of a Monte Carlo method, good agreement is found with respect to both threshold energy and structure function form. A thermal equilibrium energy spectrum is also found which is formally similar to the continuum result and which agrees at least qualitatively with particle-in-cell simulations of guiding-center plasmas. Kraichnan's Eulerian direct interaction approximation was applied to the two-dimensional inviscid Navier-Stokes equation in the vorticity representation to obtain a coupled pair of statistical equations for the vorticity autocorrelation function and its associated infinitesimal response function. Dissert. Abstr.

N76-18928 Indiana Univ., Bloomington.
OPTICAL PUMPING AND COLLISIONAL RELAXATION OF CESIUM IN HIGH MAGNETIC FIELDS Ph.D. Thesis
Thomas Robert Marshall 1975 117 p
Avail: Univ. Microfilms Order No. 76-2860

Optical pumping techniques were extended to magnetic fields as high as 100,000 gauss. At such high fields the electron is effectively decoupled from the nuclear spin permitting relaxation processes to be studied unperturbed by the effects of the hyperfine interaction. Nuclear spin independent cross sections for the collisional relaxation of the ground state electronic spin polarization of Cs133 in various noble gases were measured, and the results correlated with other measurements made at low magnetic fields where nuclear spin effects are important. The 'uniform' relaxation model in which it is assumed that every Zeeman sublevel of an atomic state can be reached with equal probability in a single relaxation event is shown to describe well the relaxation induced

on collisions of optically pumped Cs atoms with glass surfaces. Measurements of relaxation rates vs. magnetic field determined the correlation times for collisions resulting in electron spin relaxation. Dissert. Abstr.

N76-18929 Iowa Univ., Iowa City.
ELECTROSTATIC NOISE BANDS ASSOCIATED WITH THE ELECTRON GYROFREQUENCY AND PLASMA FREQUENCY IN THE OUTER MAGNETOSPHERE Ph.D. Thesis
Robert Russell Shaw 1975 115 p
Avail: Univ. Microfilms Order No. 76-2178

Naturally occurring noise bands near the electron plasma frequency are frequently detected by the University of Iowa plasma wave experiment on the IMP 6 satellite in the region from just inside the plasmapause to radial distances of about 10 earth radii in the outer magnetosphere. The electric field strength of these noise bands is usually small with electric field spectral densities typically near 10 to the 15th power volts squared/sq m Hz (broadband field strengths of about two microvolts per meter). A wave magnetic field was detected only in a few unusually intense cases, and in these cases the magnetic field energy density is several orders of magnitude smaller than the electric field energy density. The bands are observed at all magnetic latitudes covered by the IMP 6 orbit, and appear to be a permanent feature of the outer magnetosphere. They are found at all local times and occur least frequently in the quandrant from 18 to 24 hours. Dissert. Abstr.

N76-18930 Wisconsin Univ., Madison.
OBSERVATIONS OF PLASMA PRODUCTION AND DENSITY FLUCTUATIONS DURING AN OHMIC DISCHARGE IN A TOROIDAL QUADRUPOLE Ph.D. Thesis
Gregory Leopold Schmidt 1975 180 p
Avail: Univ. Microfilms Order No. 75-23871

Either or both the main poloidal and toroidal magnetic fields could be used to produce the discharge. Calculations of an average induced parallel electric field are discussed; formation of the plasma spatial profile was studied. Mechanisms which could be responsible for the fluctuations are considered. Langmuir probes were the primary plasma diagnostic employed. Dissert. Abstr.

N76-18931*# Parker (Lee W.), Inc., Concord, Mass.
COMPUTATION ON COLLISIONLESS STEADY-STATE PLASMA FLOW PAST A CHARGED DISK
Lee W. Parker Feb. 1976 105 p refs
(NASA Order H-16314-B)
(NASA-CR-144159) Avail: NTIS HC $5.50 CSCL 20I

A computer method is presented using the 'inside-out' approach, for predicting the structure of the disturbed zone near a moving body in space. The approach uses fewer simplifying assumptions than other available methods, and is applicable to large ranges of the values of body and plasma parameters. Two major advances concerning 3-dimensional bodies are that thermal motions of ions as well as of electrons are treated realisitically by following their trajectories in the electric field, and the technique for achieving self-consistency is promising for very large bodies. Three sample solutions were obtained for a disk-shaped body, charged negatively to a potential $4kT/e$. With ion Mach number 4, and equal ion and electron temperatures, the wakes of a relatively small body (radius 5 Debye lengths) and a relatively large body (radius 100 Debye lengths) both begin to fill up between 2 and 3 body radii downstream. For the large body there is in addition a potential well (about $6kT/e$ deep) behind the body. Increasing the ion Mach number to 8 for the large body causes the potential well to become wider and longer but not deeper. For the large body, the quasineutrality assumption is validated outside of a cone-shaped region in the very near wake. For the large as well as the small body, the disturbed zone behind the body extends transversely no more than 2 or 3 body radii, a result of significance for the design of spacecraft boom instrumentation. Author

N76-18932*# Boeing Co., Seattle, Wash. Aerospace Group.
PLASMA STERILIZATION TECHNOLOGY FOR SPACECRAFT APPLICATIONS Final Report
S. J. Fraser, R. L. Olson, and W. M. Leavens Sep. 1975 158 p Prepared for JPL
(Contracts NAS7-100; JPL-953647)
(NASA-CR-146314) Avail: NTIS HC $6.75 CSCL 20I

The application of plasma gas technology to sterilization and decontamination of spacecraft components is considered. Areas investigated include: effective sterilizing ranges of four separate gases; lethal constituents of a plasma environment; effectiveness of plasma against a diverse group of microorganisms; penetrating efficiency of plasmas for sterilization; and compatibility of spacecraft materials with plasma environments. Results demonstrated that plasma gas, specifically helium plasma, is a highly effective sterilant and is compatible with spacecraft materials. J.M.S.

N76-18933*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
ANGULAR DISTRIBUTION OF PHOTOELECTRONS AT 584A USING POLARIZED RADIATION
W. H. Hancock and James A. R. Samson [1975] 13 p refs
(Grant NGR-28-004-021)
(NASA-CR-146319) Avail: NTIS HC $3.50 CSCL 20I

Photoelectron angular distributions for Ar, Xe, N2, O2, CO, CO2, and NH3 were obtained at 584 A by observing the photoelectrons at a fixed angle and simply rotating the plane of polarization of a highly polarized photon source. The radiation from a helium dc glow discharge source was polarized (84%) using a reflection type polarizer. Author

N76-18934*# Illinois Univ., Urbana.
CALCULATIONS OF THE ELECTRON ENERGY DISTRIBUTION FUNCTION IN A URANIUM PLASMA BY ANALYTIC AND MONTE CARLO TECHNIQUES Ph.D. Thesis
Charles Gary Bathke 1976 119 p refs
(Grant NsG-1063)
(NASA-CR-146332) Avail: NTIS HC $5.50 CSCL 20I

Electron energy distribution functions were calculated in a U235 plasma at 1 atmosphere for various plasma temperatures and neutron fluxes. The distributions are assumed to be a summation of a high energy tail and a Maxwellian distribution. The sources of energetic electrons considered are the fission-fragment induced ionization of uranium and the electron induced ionization of uranium. The calculation of the high energy tail is reduced to an electron slowing down calculation, from the most energetic source to the energy where the electron is assumed to be incorporated into the Maxwellian distribution. The pertinent collisional processes are electron-electron scattering and electron induced ionization and excitation of uranium. Two distinct methods were employed in the calculation of the distributions. One method is based upon the assumption of continuous slowing and yields a distribution inversely proportional to the stopping power. An iteration scheme is utilized to include the secondary electron avalanche. In the other method, a governing equation is derived without assuming continuous electron slowing. This equation is solved by a Monte Carlo technique. Author

N76-18935# Hughes Aircraft Co., Culver City, Calif. Aerospace Groups.
LASER FUSION STUDY. VOLUME 1: STUDY RESULTS Final Report
Jun. 1975 313 p refs Sponsored by ERDA Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-13639-Vol-1) Avail: NTIS HC $18.75

The primary goal of this study was to devise, evaluate, and conceptually design a complete, end-to-end, alignment system capable of handling 30 to 32 Shiva amplifier chains to specified accuraces in space and time. A secondary goal was to accomplish the primary goal with an acceptably low development and procurement cost and with an acceptably high day-after-day performance reliability. This report presents such a system; it is comprised of sensors, actuating mechanisms, controls, and displays that perform well within the current art-state. NSA

N76-18936# New York Univ., N.Y. Magneto-Fluid Dynamics Div.
REFLECTION OF A POINT DISTURBANCE FROM A CONDUCTING WALL IN TWO-DIMENSIONAL MAGNETOHYDRODYNAMICS Interim Report
Harold Weitzner Jun. 1975 58 p refs
(Grant AF-AFOSR-2053-71; AF Proj. 9749)
(AD-A015903; AFOSR-75-1396TR) Avail: NTIS CSCL 20/9

In order to study the effects of tied magnetic lines in ideal magnetohydrodynamics, the simple problem is treated of the reflection of an initial point disturbance, i.e. delta function from a conducting wall in two-dimensional magnetohydrodynamics linearized about a constant state. The lowest order magnetic field is taken normal to the conducting wall. The conducting wall is the line x = 0 and the initial disturbance is at x = x sub o, Y = 0. The solution separates into three parts, the ordinary wave generated by a point disturbance at x = x sub o, y = 0, a reflected wave centered at the image point c = -x sub o, y = 0, and a third uncentered wave. The first reflected wave contains a disturbance similar to the ordinary wave and a centered simple wave. The uncentered wave and its nonself-similar wave fronts are described. The presence of lacunae, line singularities, and the nature of the singularities at the wave fronts are discussed. GRA

N76-18937# Naval Research Lab., Washington, D.C.
EFFECTS OF A FINITE DEBRIS DENSITY PROFILE ON THE DEVELOPMENT OF THE LONGMIRE SHELL
D. L. Book and R. W. Clark Jun. 1975 17 p refs
(DNA Proj. NWED-QAXH C017)
(AD-A015617; NRL-MR-3066) Avail: NTIS CSCL 20/9

Two models of the early-time spherical expansion of a debris plasma into a stationary magnetized plasma are compared. One is essentially that of Longmire, generalized to spherical geometry, while the second differs in possessing a finite (Gaussian) density profile at the leading edge, rather than the discontinuous profiles assumed by Longmire. In the finite-profile case a relatively thick shell of magnetic compression develops where the streaming and ambient plasma densities are comparable. At very early times, the peak magnetic intensity is much lower than that predicted by Longmire. Numerical calculations of high-altitude bursts provide quantitative agreement with analytical results. They also reveal that discontinuous profiles introduce unphysical processes. This confirms the theoretical analysis which shows that the discontinuous model can give rise to superluminous (v=c) electron velocities. It is thus shown that, even in the absence of anomalous plasma dissipative mechanisms, a realistic model of the debris fron is essential in simulating the evolution of the fireball and weapon debris. GRA

N76-18938# Naval Research Lab., Washington, D.C.
ON THE SHEAR INDUCED GROWTH AND DAMPING OF WAVES Interim Report
Wallace M. Manheimer Oct. 1975 11 p refs
(NRL Proj. H02-37)
(AD-A016182; NRL-MR-3139) Avail: NTIS CSCL 20/9

It is shown very simply with a time domain analysis that shear always stabilizes positive or negative energy waves. If the mode energy changes sign as a function of position however, shear may destabilize the wave. GRA

N76-18939# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
IONOSPHERIC AERODYNAMIC RELATED TO SATELLITES AND SPACE VEHICLES Final Report
R. S. B. Ong 10 Aug. 1975 17 p refs
(Grant AF-AFOSR-2224-72; AF Proj. 9783)
(AD-A015865; AFOSR-75-1856TR) Avail: NTIS CSCL 20/9

This report summarizes an investigation of the behavior of the ionospheric plasma at high altitudes and especially the onset and growth of disturbances due to the many kinds of instabilities inherently present in the nonhomogeneous plasma. Furthermore the nonlinear interactions among particles and waves are thoroughly studied. GRA

N76-18940# Massachusetts Inst. of Tech., Cambridge. Francis Bitter National Magnet Lab.
LASER-PRODUCED PLASMAS AND RADIATION SOURCES Final Report, 1 Jul. 1972 - 30 Jun. 1975
B. Lax, W. Halverson, and D. R. Cohn Aug. 1975 52 p refs
(Contract F44620-72-C-0090; AF Proj. 9751)
(AD-A015921; AFOSR-75-1355TR) Avail: NTIS CSCL 20/9

An experimental and theoretical study of CO2 laser-induced gas breakdown, laser heating of magnetically confined plasma, and emission of soft X-rays from laser-heated plasma has been performed. Demonstrations were made of the roles of electron diffusion, pulse time, and inelastic losses in laser-induced gas breakdown. The phenomenon of CO2 laser beam self-trapping and associated plasma dynamics were studied. High-Z plasma impurities and magnetic field were shown to increase the heating and soft X-ray emission from CO2 laser-heated plasmas. GRA

N76-18941# California Univ., Los Angeles. School of Engineering and Applied Science.
PHASE-INVARIANT SOLUTIONS OF NONLINEAR WAVE-WAVE INTERACTING SYSTEMS
P. K. C. Wang Jul. 1975 24 p refs
(Grant AF-AFOSR-2662-74; AF Proj. 9752)
(AD-A015838; UCLA-ENG-7549; AFOSR-75-1314TR) Avail: NTIS CSCL 20/9

The existence of phase-invariant solutions for a class of nonlinear wave-wave interacting systems is studied. These solutions have the property that the phase of each wave is invariant with time or unaffected by the nonlinear interactions. Explicit results are obtained for certain two-wave and three-wave systems. It is shown that for these systems, the wave-energy transfer along the phase-invariant solutions is always unidirectional. The application of these results to the nonlinear interaction between two transverse waves and a longitudinal wave in a magnetized collisionless plasma is discussed. GRA

N76-18942# STD Research Corp., Arcadia, Calif.
NONLINEAR LOSS MECHANISMS IN ADVANCED MAGNETOHYDRODYNAMIC GENERATORS Final Report
S. T. Demetriades, C. D. Maxwell, E. D. Doss, D. A. Oliver, G. S. Argyropoulos, C. D. Aliprantis, J. C. Cutting, and S. A. Zwick 30 May 1975 118 p refs
(Contract F44620-73-C-0001; AF Proj. 9752)
(AD-A015769; STD-75-013; AFOSR-75-1432TR) Avail: NTIS CSCL 10/2

Development of improved computer codes for solving the MHD problem has led to improved techniques for inverting the large matrixes that appear in the formulation and application of STD Research Corporation's direct solution of the electrical part of the MHD problem. Application of the STD Research MHD-generator-simulation computer codes to real MHD channels has verified the validity and accuracy of these codes by direct comparison with large-scale experiments. The influence of wall roughness on MHD channel performance has been studied theoretically and it has been found that roughness effects are calculable and in good agreement with experiments. A new phenomenon peculiar to MHD flows, electromagnetic roughness, has been discovered but its investigation was limited to qualitative predictions. The influence of electrode coatings, electron temperature elevation, thermochemistry and transport property changes in the boundary layer was investigated and it was concluded that most losses in MHD generators originate in the boundary layer and electrode voltage drops are calculable with high accuracy. Methods for significantly improving the performance and longevity of MHD generators by boundary layer and surface coating control were investigated theoretically and small-scale experiments for verifying these results are recommended. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-18943 Ohio State Univ., Columbus.
COMPUTER SIMULATIONS OF ELASTICALLY STRAINED SURFACES AND GRAIN BOUNDARIES IN BCC CRYSTALS Ph.D. Thesis
Clifford Warren Price 1975 249 p
Avail: Univ. Microfilms Order No. 76-3528

Computer simulation studies were conducted to determine the possible role of the surface-stress tensor in the operation of dislocation surface sources. A computer program was developed to simulate elastic strains in infinite bulk crystals, and the output from this program was used to generate the computation cell and periodic boundaries for the simulations. This enabled

simulations to be made in both the unstrained and the strained state. The simulations were restricted to bcc Fe and W using the Johnson I potential. The thermodynamic equation relating the surface stress tensor to the surface energy was utilized in the simulations, and an alternate method for calculating the surface-stress tensor from unbalanced interatomic force differences was developed. The agreement between the two techniques was excellent, implying that the modeled surface did obey the thermodynamic relation. Dissert. Abstr.

N76-18944 Maryland Univ., College Park.
FREQUENCY DEPENDENCE OF RELATIVE INTENSITIES FOR RESONANCE RAMAN SCATTERING Ph.D. Thesis
Robert Shih-Liang Chao 1975 104 p
Avail: Univ. Microfilms Order No. 76-3807

Theoretical expressions for the frequency dependence of the intensities of Raman lines in the pre-resonance and rigorous resonance Raman scattering are derived. In this effort the main contribution to the change in polarizability was obtained from the derivative of electronic transition moment with respect to the vibrational normal coordinates. The approach differs from the earlier ones which contend that the main contribution to the polarizability change comes from the derivative of electronic frequency with respect to the normal coordinate. The experimental data on potassium manganate and azulene, as well as the literature reported data on chromate ion, vanadium tetrachloride and tin tetra-iodide are analyzed in light of theoretical results. Excellent agreement between the experimental data and the theoretical results lends support to the approach used in the rigorous resonance region, the effective frequency and the damping term were determined from the excitation profile rather than the electronic absorption profile. Dissert. Abstr.

N76-18945 State Univ. of New York, Albany.
FIRST PRINCIPLE STUDY OF BAND STRUCTURE AND ELECTRONIC PROPERTIES OF FERROMAGNETIC NICKEL METAL Ph.D. Thesis
Nimain Charan Mohapatra 1975 258 p
Avail: Univ. Microfilms Order No. 76-1907

A first principle calculation of the band structure and a number of associated properties of ferromagnetic nickel was carried out. In obtaining the band structure, a variational procedure was used. This calculation, in common with earlier work on iron and cobalt has the following salient features. To represent both diffuse free-like and semi-localized d-like bands, a choice of basis set consisting of a linear combination of plane waves and tight-binding functions of the atomic 3d orbital was made. The basis set was augmented by including tight-binding functions of the atomic core orbitals for obtaining the core orbitals appropriate to the metal. A truncation procedure for atomic 3d orbital was adopted to avoid the occurrence of three and four center integrals for the evaluation of the matrix elements. Correlation effects were incorporated into the Hamiltonian matrix in a direct way by using atomic results for core states in metal, recent perturbation calculation results for free electron gas, for free-like states and an effective exchange formula due to Hubbard for the d-like states. Dissert. Abstr.

N76-18946 Saint Johns Univ., Jamaica, N.Y.
LAW OF CORRESPONDING STATES IN ELASTIC SCATTERING THEORY Ph.D. Thesis
Nicholas Milin 1975 64 p
Avail: Univ. Microfilms Order No. 76-2997

The idea of corresponding states was utilized in statistical mechanics to summarize and correlate empirical data, to study the quantum effects in various properties of matter, to predict the properties of a substance from the experimental data of other substances where no satisfactory theoretical treatment existed - to name a few. Similar possibilities for utilizing the idea of corresponding states exist in the elastic scattering where one is faced with the practically impossible theoretical problem of evaluating the T-matrix when calculating the scattering cross-section in analogy with a similarly difficult problem of calculating the partition function in statistical mechanics. Analogous to the law of corresponding states (LCS) of statistical mechanics, a law of corresponding states in elastic scattering theory is derived by means of operator methods, enabling us to relate cross-sections of different scattering systems. Applications of LCS in elastic scattering are given where experimental data is used to relate hitherto theoretically unrelated scattering cross-sections. Dissert. Abstr.

N76-18947 Indiana Univ., Bloomington.
ON THE DEGREE OF DYNAMICAL CHARGE OVERLAP IN IONIC CRYSTALS Ph.D. Thesis
Andrew Chung-Keung Man 1975 122 p
Avail: Univ. Microfilms Order No. 76-2859

The degree of electronic charge overlap in SrC12:Sm2+ has been determined from vibronic and static stress data, and compared with that in SrF2:Sm2+. Electric dipole allowed electronic transition from the 4f6(A sub 1g) ground state to the lowest energy 4f55d(T sub 1u) excited state of the probe ion, Sm2+, is observed in absorption spectra. The vibrational motion of the lattice modulates the electronic transition giving rise to the vibronic sideband, from which the lattice dynamics of the host lattice are extracted. The ratio of the electron-phonon coupling strengths of the different vibrational modes are determined independently from measurements of the effects of static stress on the same localized electronic transition. In the analysis of the spectra, a quasi-classical model is used in which electronic charge overlap effects are specifically included. Results imply that there exists less charge overlap in SrCl2 than in SrF2. Dissert. Abstr.

N76-18948 Nebraska Univ., Lincoln.
ELECTRON EXCITATION OF HYDROGEN USING AN EXTENDED GLAUBER APPROXIMATION Ph.D. Thesis
John Norman Gau, Jr. 1975 79 p
Avail: Univ. Microfilms Order No. 76-2021

Elastic and inelastic electron-hydrogen scattering is considered using an unrestricted version of the Glauber approximation. The integral expressions derived are shown to reduce to those of the restricted Glauber approximation when q approaches 0 for 1s approaches ns excitation and to give the same divergent behavior as the conventional restricted Glauber approximation when q, the momentum transfer, approaches zero. The integrals for the electron-electron and the electron-nucleus interactions can be separated and evaluated analytically in the asymptotic limit of large q. The electron-nucleus term is shown to be dominant and to have Rutherford-like dependence on q for fixed energy at large q. Cross sections and Fano-Macek alignment and orientation parameters were computed numerically for various scattering angles and incident energies. The total cross sections and polarization fraction of Ly-alpha radiation agree closely with Byron's Monte-Carlo integrations of the generalized Glauber transition matrix. The states excited as a function of scattering angle are found to be elliptically polarized in our calculations in contrast to the predictions of the Born and conventional eikonal-type approximations. Dissert. Abstr.

N76-18949 Kansas State Univ., Manhattan.
BACKSCATTERING OF He+ AND H+ PARTICLES FROM ULTRA THIN FILMS IN THE ENERGY RANGE 50-100 keV Ph.D. Thesis
Harvey Jay Goldberg 1975 93 p
Avail: Univ. Microfilms Order No. 76-2930

In order to test the applicability of the potential arising from Lindhard's Thomas-Fermi treatment of the interaction between two atoms, the elastic collision cross sections of He (+) and H(+) ions incident on targets of Au, Ag, Cu, Bi, Ni, and In were measured. The ions were accelerated to energies ranging from 50 keV to 100 keV and were made to collide with the target material. Those ions that had been scattered through a laboratory angle of 150 deg were detected and energy analyzed. The targets consisted of vacuum depositions of the target material of density equivalent to less than a monolayer, deposited on commercially available, glass mounted, 40 microgram/sq cm carbon foils. The results obtained clearly illustrate the efficacy of the Lindhard description for elastic collisions in this energy range. In addition, they further show that fractional monolayer vacuum evaporated targets can be used for these measurements. Dissert. Abstr.

N76-18950 Polish Academy of Sciences, Warsaw.
QUASI-HYDRODYNAMIC MODELS IN THE MULTI-BODY THEORY AND KINETICS OF PHASE TRANSFORMATIONS

Lukasz A. Turski 23 Jun. 1975 99 p refs In POLISH
Avail: Issuing Activity

Certain aspects of a quasi-continuum description and certain applications of this description are presented. Formulation of the dynamics of a system of classical and quantum particles is discussed along with possibilities of extending this formalism to a system of relativistic particles. The possibilities of using the algebraic method of currents for reformulating statistical physics were investigated. Transl. by M.J.S.

N76-18951 Texas A&M Univ., College Station.
A STUDY OF THE CURRENT DISTRIBUTION, ELECTROMAGNETIC RESPONSE FUNCTION, AND PROXIMITY EFFECT IN SUPERCONDUCTING AMORPHOUS Bi FILMS Ph.D. Thesis
Joseph Daniel Lejeune 1975 88 p
Avail: Univ. Microfilms Order No. 76-3649

Kinetic inductance measurements were used to probe the degree of current distribution uniformity that exists within thin superconducting amorphous Bi films. These measurements were made on films having various cross-sections which were condensed on both quartz plates and Nb shield planes. The Nb shield plane appeared to smooth the current distribution considerably. Measurements of the kinetic inductance were also used to determine the temperature dependence of the electromagnetic response function in amorphous Bi films. The zero temperature response function for these films was evaluated using strong-coupling theory and gap parameter data derived from tunneling measurements. With this value for the response function, an unambiguous determination of the zero temperature penetration depth, gamma (0), was possible. Dissert. Abstr.

N76-18952 Wisconsin Univ., Madison.
SIMULTANEOUS IONIZATION AND EXCITATION OF HELIUM TO THE 4S, P, D, F STATES OF He + BY ELECTRON IMPACT Ph.D. Thesis
William Daniel Evans 1975 129 p
Avail: Univ. Microfilms Order No. 75-23841

The simultaneous ionization and excitation process of helium by electron impact was studied by observing the fine structure of the He II 4686A radiation (4S,4P,4D,4F - 3S,3P,3D) at electron energies of 80 to 300 eV. A dual etalon 150 mm aperture, high-resolution scanning Fabry-Perot interference spectrometer was used to resolve the thirteen fine structure components. The ionization-excitation cross sections of the 4S states are in reasonable agreement with theoretical values. Over the energy range of 4P cross sections are about three times larger than the 4S and 4D cross sections, which are of comparable magnitude, and much larger than the 4F cross sections. The pressure dependence of the apparent excitation cross sections was measured at an electron energy of 200 eV over the region 2-140 milli-Torr at 85 K and 18-140 milli-Torr at 300 K.
Dissert. Abstr.

N76-18953*# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
ELECTROSTATIC ANALYSIS OF CHARGE-COUPLED STRUCTURES
James D. Gassaway Feb. 1976 96 p ref
(Contract NAS8-26749)
(NASA-CR-144175; EIRS-EE-74-1) Avail: NTIS HC $5.00 CSCL 20L

An analysis is presented which is based upon a numerical solution of Gauss's law for the multiple dielectric semiconductor and electrode structure. The formulation resulted in a large set of equations, usually nonlinear, which were solved by an iterative scheme based upon the Gauss-Seidel method employing a relaxation parameter. Proper consideration of the nonlinearity of the space-charge in the semiconductor allowed convergent solutions which can give reasonable approximations to the channel potential profiles though not as good for estimating the space charge itself. The results of this work, which are three computer programs, are listed. None of the programs give the electric field explicitly as output data. However, when this information is desired, the programs can be expanded to include field estimations based on a polynominal fit to the potential field, or they may serve as subprograms for main programs dealing with general aspects of charge transfer. Author

N76-18954# California Univ., Berkeley. Lawrence Berkeley Lab.
LARGE SUPERCONDUCTING SOLENOID FOR THE MINIMAG EXPERIMENT
M. A. Green Jul. 1975 25 p refs Presented at the Intern. Cryog. Mater. Conf., Kingston, Canada, 22 Jul. 1975 Sponsored by ERDA
(LBL-3677) Avail: NTIS HC $4.25

The MINIMAG experiment detects and analyzes charged and neutral particles that result from the collisions of electrons and positrons in SPEAR 2. The large superconducting solenoid, which detects charged particles, must be thin from a radiation standpoint. The radiation thickness of the solenoid and its cryogenic system were set at one-third of radiation length. As a result, the 1.5 T solenoid coil has a thickness of less than 2.0 mm. The superconductor must operate at a current density in excess of 8 x 10 to the eighth power A/sq m. The solenoid, which has a diameter of about 1 m, must operate at fairly high stress (3.3 x 10 to the eighth power N/sq m) in the conductor, while the magnetic stored energy is in excess of 0.7 MJ/m. The cryogenic and refrigeration system is rather unconventional because of the stringent radiation-thickness requirements of the experiment. The magnet, its cryostat, and its refrigeration system are described, and a series of experiments which lead to the full-scale magnet are also discussed. Author (NSA)

N76-18955# Los Alamos Scientific Lab., N.Mex.
STABILIZING SUPERCONDUCTORS FOR POWER ENGINEERING APPLICATIONS
J. K. Hoffer 1975 7 p refs Presented at the Power Meeting of IEEE, San Francisco, 20-25 Jul. 1975 Sponsored by ERDA
(LA-UR-75-189; Conf-750715-1) Avail: NTIS HC $4.00

Exhibiting essentially zero resistivity at high current densities and large magnetic fields, modern superconducting materials offer intriguing possibilities in power engineering. The essential differences between superconductors and ordinary conductors are discussed along with the control of heat generation resulting from magnetic flux motion necessary to insure that the superconductor is stable. Some experiments on models of dc superconducting transmission cables which test the theoretical assumptions are included. Author (NSA)

N76-18956# California Univ., Berkeley. Lawrence Berkeley Lab. Inorganic Materials Research Div.
IRRADIATION INDUCED DISLOCATION CLIMB IN Cu-Al ALLOYS OF DIFFERENT STACKING FAULT ENERGIES Ph.D. Thesis
T. H. Kosel Jun. 1975 105 p refs
(Contract W-7405-eng-48)
(LBL-3590) Avail: NTIS HC $8.25

Irradiation induced climb of dislocations due to preferential absorption of interstitials was studied by irradiating Cu-Al alloys of different stacking fault energies. Nucleation of rhombus shaped perfect dislocation loops was observed, and their growth was studied. The sides of the loops lay accurately on the two (111) planes which contain the Burgers vector and were often bowed out slightly on these glide planes. Rotation of the loops on the glide cylinder away from the pure edge orientation was observed, as well as loss of loops by slip along the glide cylinder to the foil surface. These observations suggest that the jog density on the loop sides is low. It is shown that at a given temperature there exists a minimum damage rate for growth, and that this is strongly dependent on stacking fault energy. This is discussed in terms of a model in which the rate controlling process in the climb of these loops is assumed to be the nucleation of jogs.
Author (NSA)

N76-18957# California Univ., Berkeley. Lawrence Berkeley Lab.
MULTIPHONON RELAXATION AND EXCITATION TRANSFER IN RARE-EARTH POPED GLASSES Ph.D. Thesis
C. B. Layne 31 Jul. 1975 64 p refs
(Contract W-7405-eng-48)
(UCRL-51862) Avail: NTIS HC $5.45

The theory of multiphonon relaxation for rare-earth ions in crystals is extended to nonradiative relaxation in glasses. The expected exponential dependence of the multiphonon rates on energy gaps was verified for 5 oxide glass compositions; the

active phonons were identified to be the high-energy molecular vibrations of the network forming ions. The multiphonon rates are determined by the highest phonon energies. Coupling of the rare earth to phonons is relatively constant in oxide glasses, but may vary in halide or chalcogenide glasses. The influence of nonradiative rates on the performance of a Nd : glass laser is assessed, with the theory being verified. Energy transfer in Nd : glass accounts for the observed nonexponential fluorescence decay of excited Nd ions. Coupling between Nd ions is due to dipole-dipole interaction. Lifetime decreases with Nd content. Results can be used to predict the fluorescent behavior and performance of new laser glasses. Energy transfer from Ce to Nd in laser glass was observed. Author (NSA)

N76-18958# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

PIEZO- AND PYROELECTRIC PROPERTIES OF ELECTRETS Final Report, 1 Jan. - 31 Dec. 1975

Martin G. Broadhurst and G. Thomas Davis Oct. 1975 56 p refs

(AD-A016844; NBSIR-75-787) Avail: NTIS CSCL 11/9

A model for piezo- and pyroelectricity in polymers is presented. These effects are true piezo- and pyroelectricity rather than electrostriction, conduction, electromechanical effects or the motion of conductors in the field of space charges. Two distinct types of polymers can be piezoelectric. Amorphous polymers are piezo- and pyroelectric by virtue of a non-equilibrium but kinetically stable net dipole orientation. The semicrystalline polymers are piezoelectric due to alignment of polar, ferroelectric crystals dispersed in the amorphous phase. In both types the magnitudes of the piezo- and pyroelectric effects are in accord with the expected temperature and pressure dependence of the dipolar polarization. Space charges embedded in the polymer normally will not produce a piezo- or pyroelectric current. Those embedded near the crystal-liquid interfaces tend to reduce the piezo- and pyroelectricity. Improved orientation of dipoles and reduction of ionic impurities should increase p and d for PVF2 by a factor of three above typical values presently reported. The sensitivity of amorphous polymers is limited mainly by dipole moment per unit volume and breakdown strength. GRA

N76-18959# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.

PROCEEDINGS OF PIEZOELECTRIC AND PYROELECTRIC SYMPOSIUM-WORKSHOP Final Report

Martin G. Broadhurst Sep. 1975 224 p refs Symp. held at Gaithersburg, Md., 15-16 Apr. 1975

(AD-A016843; NBSIR-75-760) Avail: NTIS CSCL 11/9

Contents: Piezoelectricity in polarized polyvinylidene fluoride; Piezoelectric polymer research in Japan; The melting temperature-composition curves of poly(vinylidene fluoride)-poly (vinyl fluoride) mixtures and vinylidene fluoride-vinyl fluoride copolymers; Texture and pyroelectricity in polyvinylidene fluoride; Dependence of the piezoelectric activity of polyvinylidene fluoride upon high speed uniaxial stretching and subsequent poling; Thermally stimulated currents and morphology in PVF2; Piezoelectricity and pyroelectricity in a poly(vinylidene fluoride-tetrafluoroethylene copolymer; Polyvinylidene fluoride as an active device element; Scanning for ferroelectricity in polycrystalline materials; Origins of persistent electrical polarization in polymer solids; Pyroelectric polymers applied to optical radiation measurements; Pyroelectricity in PVF2; Preliminary investigations of piezoelectric polymers; Piezoelectric polymer measuring instruments. GRA

N76-18960# Naval Research Lab., Washington, D.C.

METALLURGICAL PROCESSING AND SUPERCONDUCTING PARAMETERS OF THE V3Ga A15 PHASE Final Report

B. N. Das, R. W. Huber, and J. E. Cox 10 Sep. 1975 47 p refs

(NRL Proj. M01-09; RR0220146)

(AD-A015944; NRL-7907) Avail: NTIS CSCL 20/3

The solid-state bcc-to-A15 phase information in V3Ga, the extension of this A15 phase field on both sides of the stoichiometric composition, and the high-field current-carrying capacity of V3Ga composite wires make V3Ga attractive for investigating how structure determines superconducting properties. However the extended freezing range in the V-Ga binary system promotes both dendritic segregation and a large-scale radial Ga gradient. For systematic study of the interrelations among the metallurgical processing procedures, the resultant microstructures, and the superconducting properties of the V3Ga A15 phase, eleven alloys, spanning the composition range of the A15 phase field and the adjacent two-phase fields, were arc-melting and cast as 1.3 cm-diameter rods. The dendritic segregation in the cast materials was made visible in metallographic sections by etching. A brief heat treatment at temperatures in the bcc-phase field eliminates the dendritic segregation and reduces the radial Ga gradient. By rapidly cooling the specimen through the bcc-to-A15 transformation, segregation from the transformation is on a fine scale and can be removed by a subsequent anneal within the beta-phase field. The transformed microstructures and the annealed microstructures of all materials of the V3Ga A15 phase were similar, and even microhardness was nearly constant over the full broad composition range of the V3Ga phase. The lattice parameter of the A15 V3Ga phase, measured by powder X-ray diffraction, increased with increasing Ga content. The present measurements define two lines intersecting near the V3Ga composition. GRA

N76-18961# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

DETERMINATION OF TEXTURE POLE FIGURES USING PICKER FACS-1 APPARATUS Technical Report, Apr. - Dec. 1974

L. A. Jacobson and Robert Schafrik Jun. 1975 48 p refs

(AF Proj. 7021)

(AD-A015731; ARL-75-0190) Avail: NTIS CSCL 20/2

The Picker FACS-1 Apparatus consists of a three axis goniometer, with associated X-ray generating and detecting equipment, controlled by a dedicated PDP-8 minicomputer. By means of a control program developed at Vanderbilt University, it is possible to generate values of integrated X-ray diffraction peak intensity over preselected goniometer rotation angles. A specimen of the type proposed by Lopata and Kula, consisting of a plane cut at equal angles to the principal material axes (54 deg 44 ft), can be conveniently rotated to obtain data for an entire quadrant of the stereographic projection. Equations are presented for converting goniometer angles to latitude and longitude, and for converting latitude and longitude to rectangular coordinates for automatic plotting. A description of the plotting routine is presented along with examples of several texture plots. Author (GRA)

N76-18962# King's Coll., London (England). Dept. of Physics.

CRITICAL BEHAVIOR IN MANY BODY SYSTEMS

C. Domb Sep. 1975 12 p

(Grant DAERO-75-G-0028; DA Proj. 200-61102-B-11B)

(AD-A016170) Avail: NTIS CSCL 20/12

Earlier studies of the simple Ising model have been extended and the techniques applied to a variety of multistate and multispin models. Briefly presented is the authors' research results in which they have developed methods for the derivation of series developments for the Potts model, for which one of the most interesting questions is the order of the transition, for Ising models with four-spin interactions (including the eight-vertex model) and the three-spin triangular Ising model. For the three-spin triangular Ising model it has been found possible to conjecture the exact form of the spontaneous magnetisation. They have also continued to study the general cluster expansion for the high temperature specific heat of the Ising model of a ferromagnet. High field expansions have been derived for the Ising model on the hydrogen peroxide lattice. The exploration of the size and shape of polymer chains using insight gained from critical phenomena has continued. GRA

N76-18963# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

IMPROVED METHODS FOR PREPARING MATERIALS FOR MAGNETIC AND MAGNETO-OPTIC APPLICATIONS Final Report

Sep. 1975 113 p refs

(Contract N00014-67-A-0097-0019)

(AD-A015693) Avail: NTIS CSCL 20/12

A number of new techniques have been tried to improve

methods for preparing various materials for magnetic and magneto-optic application. First, a high-pressure autoclave system has been developed that is capable of achieving temperatures of 1350C and pressures of 1500 atm, conditions which have not been previously obtainable. Experiments were carried out to optimize conditions for growth of rare-earth garnets from various types of fluxes. Second, a number of experiments were performed to explore the possibilities of using a vapor transport technique in synthesizing compounds containing rare earth, such as Nd, Dy, and Y with sulphur of selenium and gallium or aluminum. Third, new iron-free garnets, Na2ErMg2V3O12, have been obtained by slow cooling flux techniques using sodium vanadate as a solvent. GRA

N76-18964# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
THEORETICAL SEARCH FOR SUPER-VELOCITY SEMICONDUCTORS Annual Technical Report, Jun. 1974 - Jun. 1975
M. A. Littlejohn Sep. 1975 31 p refs
(Contract N00014-70-A-0120-0004; NR Proj. 243-006; RR0210203)
(AD-A015697) Avail: NTIS CSCL 20/12

This report describes work in two different areas. First of all, the progress made toward the synthesis of GaN thin films from chemical vapor deposition using the organometallic triethylgallium monamine (Ga(C2H5)3.NH3) is described. Electrical properties, mass spectrometry measurements, and surface ion mass spectrometry (SIMS) measurements are reported. Also, a discussion is given of a Monte Carlo calculation of the high field transport properties of GaN. This represents an effort toward developing a general Monte Carlo computer program for calculating the high field behavior of materials which offer the possibility for achieving high saturated drift velocities. GRA

N76-18965# Chicago Univ., Ill. Div. of Physical Sciences.
EXPERIMENTAL INVESTIGATION OF THE ELECTRONIC PROPERTIES OF SOLIDS Final Report, 1 Jan. 1971 - 30 Jun. 1975
H. Fritzsche Sep. 1975 27 p refs
(Contract F44620-71-C-0025; AF Proj. 9763)
(AD-A015875; AFOSR-75-1417TR) Avail: NTIS CSCL 20/12

The core state and interband optical transitions and scaling laws relating these in different material systems are studied at high photon energies and with intense synchrotron radaition to aid material development. The electronic states, transport processes, contact and surface properties, the internal stress, and photoinduced structural changes of amorphous semiconductors are investigated to characterize and understand electronic processes in noncrystalline systems and amorphous semiconductor devices. Author (GRA)

N76-18966# Magnetic Corp. of America, Waltham, Mass.
DESIGN, CONSTRUCTION AND TESTING OF A PULSED HIGH ENERGY INDUCTIVE SUPERCONDUCTING ENERGY STORAGE SYSTEM Final Report, 1 Apr. 1971 - 4 Apr. 1975
E. J. Lucas, W. F. B. Punchard, P. M. G. Margosian, R. J. Thome, R. J. Camille, Z. J. J. Stekly, R. J. Powers, and P. W. Dippolito Sep. 1975 292 p refs
(Contract F33615-71-C-1454; AF Proj. 3145)
(AD-A015892; MCA-TR-WP-10-2; AFAPL-TR-75-60) Avail: NTIS CSCL 10/3

Major problems associated with inductive energy storage systems operated at high repetition rates include: breaking high currents in inductive circuits; developing a low loss superconductor and from it building a coil which remains superconducting during the rapid charge period; and building a low heat leak non-conducting dewar. Theoretical analyses concerning conductor energy losses, transient heating effects, electrical circuits, and switch actuation, were conducted. To confirm these analyses experiments were conducted on model non-conducting dewars and 1 and 7 kJ stored energy model coils using a pneumatically actuated vacuum interrupter. GRA

N76-18967# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF SOS PROCESSES FOR FABRICATION OF RADIATION HARDENED MIS DEVICES AND INTEGRATED CIRCUITS Final Report, 1 May 1974 - 31 May 1975
Ross A. Williams, Ranjeet K. Pancholy, and Donald K. Nichols May 1975 86 p refs
(Contract F19628-74-C-0199)
(AD-A015751; C74-829/501; AFCRL-TR-75-0320) Avail: NTIS CSCL 09/1

The program has the objectives of obtaining a better understanding of the radiation-induced n-channel SOS leakage problem and of examining the effects of processing variations on the radiation-induced leakage. Experiments were performed on devices from 6 processing lots--encompassing variations in silicon doping densities and techniques, device design, and device geometry. Experiments on devices having the sapphire thinned to approximately 3 mils and with a gate electrode on the sapphire demonstrated that the radiation-electrode n-channel leakage is due to inversion of the p-type silicon at the sapphire interface by positive charge trapped in the sapphire. This charge was found to saturate at a value of approximately 3 x 10 to the 11th power charges/sq cm, under conditions of -10 V drain bias during irradiation. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-18968# California Univ., Berkeley. Lawrence Berkeley Lab.
HEAT CAPACITY OF THE SUPERCONDUCTING KONDO SYSTEM (LaCe)Al2
S. D. Bader, W. E. Fogle, N. E. Philips, M. B. Maple, and C. A. Luengo Mar. 1975 8 p refs Presented at the 4th Intern. Conf. on Chemical Thermodyn., Montpellier, France, 26 Aug. 1976
(Contract W-7405-eng-48)
(LBL-3755; Conf-750816-1) Avail: NTIS HC $4.00

Heat capacity measurements were made on several (LaCe)Al2 alloys with Ce concentration varying from zero to above the turning point concentration of the re-entrant T/sub c/ vs Ce concentration curve. The measurements extend below the temperature of the maximum in C/sub n/, the normal-state heat capacity, and, for the one sample that shows re-entrant superconducting behavior, below T/sub c2/. Measurements were made on samples with 0, 0.193, 0.640, and 0.906 at. percent Ce substituted for La, in the temperature range 0.07 to 20 K, and in magnetic fields from 0 to 38 kOe. A complete analysis of the data on all samples shows that the lattice and normal state electronic heat capacities of the alloy samples are the same as those of pure LaAl2. NSA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-18969*# Forecasting International Ltd., Arlington, Va.
THE FUTURE ENVIRONMENT: US AND WORLD TRENDS
Kathryn H. Humes and Harold S. Becker (Futures Group) 15 Jul. 1975 779 p refs
(Contracts NAS5-20732; NAS5-20734)
(NASA-CR-144728) Avail: NTIS HC $18.75 CSCL 05K

The impact of rapidly developing technology and industrialization on human society and environments is considered. For individual titles, see N76-18970 through N76-18981.

N76-18970* Forecasting International Ltd., Arlington, Va.
THE FUTURE ENVIRONMENT: INTRODUCTION
In its The Future Environment 15 Jul. 1975 36 p refs (For

availability see N76-18969 09-80)
CSCL 05K

The following study objectives are considered: (1) To identify social and economic challenges which can benefit from space, and (2) to relate goals and objectives of civilian space activities to national goals and objectives. Author

N76-18971* Forecasting International Ltd., Arlington, Va.
ENERGY AND OTHER NON-RENEWABLE RESOURCES c43
In its The Future Environment 15 Jul. 1975 4 p refs (For availability see N76-18969 09-80)
CSCL 10B

Anticipated U.S. demands for non-renewable energy and mineral resources exceed domestic supplies essential for economic growth. For the long term changes necessary in the energy supply and demand gap, new technologies and substitute materials as well as legislation and socio-economic strategies are elaborated. G.G.

N76-18972* Forecasting International Ltd., Arlington, Va.
FUTURE US ENERGY DEMANDS BASED UPON TRADITIONAL CONSUMPTION PATTERNS LEAD TO REQUIREMENTS WHICH SIGNIFICANTLY EXCEED DOMESTIC SUPPLY c44
In its The Future Environment 15 Jul. 1975 39 p refs (For availability see N76-18969 09-80)
CSCL 10B

Energy consumption in the United States has risen in response to both increasing population and to increasing levels of affluence. Depletion of domestic energy reserves requires consumption modulation, production of fossil fuels, more efficient conversion techniques, and large scale transitions to non-fossile fuel energy sources. Widening disparity between the wealthy and poor nations of the world contributes to trends that increase the likelihood of group action by the lesser developed countries to achieve political and economic goals. The formation of anticartel cartels is envisioned. G.G.

N76-18973* Forecasting International Ltd., Arlington, Va.
LACK OF AGREEMENT OVER THE USE AND OWNERSHIP OF THE INTERNATIONALLY SHARED RESOURCES (SUCH AS AIR SPACE, OUTER SPACE AND THE OCEANS) LEADING TO INTERNATIONAL CONFLICT c43
In its The Future Environment 15 Jul. 1975 29 p refs (For availability see N76-18969 09-80)
CSCL 05K

The lack of adequate institutional mechanisms to regulate, monitor and govern the use of commonly owned world resources appears to be politically destabilizing and subject to socioeconomic pressures of overpopulation, food shortages, cartelism, terrorism, and wealth distribution to developing countries. The capacity and propensity to wage war and its potential consequences are elaborated. It is shown that technology is one of the dominant factors affecting the exploration and management of commonly shared resources. G.G.

N76-18974* Forecasting International Ltd., Arlington, Va.
CONTINUED URBANIZATION OF THE UNITED STATES IS CAUSING THE DETERIORATION OF THE CENTRAL CITY; COSTLY SUBURBAN DEVELOPMENTS; AND INCREASES IN CONGESTION, POLLUTION, CRIME, VIOLENCE AND ALIENATION c85
In its The Future Environment 15 Jul. 1975 30 p refs (For availability see N76-18969 09-80)
CSCL 05K

It is shown that urban sprawl and the abuses of technological industries result in substantial environmental and economic costs at the expense of center city locations and populations. Socioeconomic deterioration and modification of the biosphere triggers climatic and environmental changes leading to ecosystem damage and destruction, health consequences and international conflict. G.G.

N76-18975* Forecasting International Ltd., Arlington, Va.
POLLUTION AND CONTAMINATION OF THE DOMESTIC ENVIRONMENT LEADING TO DETRIMENTAL, LONG RUN AND POSSIBLE IRREVERSIBLE EFFECTS UPON HUMAN AND ANIMAL HEALTH AND LONGEVITY c45
In its The Future Environment 15 Jul. 1975 49 p refs (For availability see N76-18969 09-80)
CSCL 13B

Negative impacts of industrial waste disposal into the domestic environment affect human and animal health and longevity, destruct the ecosystem, and accumulate potential harmful substances in the food chain leading to disease and genetic defects in the population. G.G.

N76-18976* Forecasting International Ltd., Arlington, Va.
CONTAMINATION, MISUSE AND ABUSE OF THE GLOBAL OCEANS LEADING TO ECOSYSTEM DAMAGE AND DESTRUCTION, HEALTH CONSEQUENCES AND INTERNATIONAL CONFLICT c45
In its The Future Environment 15 Jul. 1975 26 p refs (For availability see N76-18969 09-80)
CSCL 13B

Unregulated uses of the oceans may threaten the global ecological balance, alter plant and animal life and significantly impact the global climatic systems. Recent plans to locate large scale structures on the oceans and to exploit the mineral riches of the seas pose even greater risk to the ecological system. Finally, increasing use of the oceans for large scale transport greatly enhances the probability of collision, polluting spills and international conflict. Author

N76-18977* Forecasting International Ltd., Arlington, Va.
DESTRUCTION OF THE RECREATIONAL, ASTHETIC, AGRICULTURAL, WILDLIFE CONSERVATION AND PRESERVATION, AND RESIDENTIAL USES OF THE LAND AS A RESULT OF THE ABUSES OF THE MANUFACTURING, COMMERCIAL, EXTRACTIVE, CONSTRUCTION, AND TRANSPORTATION INDUSTRIES c45
In its The Future Environment 15 Jul. 1975 23 p refs (For availability see N76-18969 09-80)
CSCL 13B

Explicit concern over land use and abuse stems from the recognition of the negative impacts of unrestrained and unregulated economic, industrial, and population growth upon finite land resources. Only one quarter of the total surface area of the earth is land, and of that a large portion is uninhabitable. The present stresses upon the land include urbanization, urban sprawl and urban congestion; electrical, nuclear industrial park siting requirements; land degradation through stripping surface minerals; land degradation through disposal of radioactive wastes, sewage sludge, solid waste and other industrial wastes; rising demand for agricultural land; and the erosion and destruction of land through elimination of protective coverings such as forests, grasslands, and wetlands. Author

N76-18978* Forecasting International Ltd., Arlington, Va.
DETERIORATION AND MODIFICATION OF THE BIOSPHERE LEADING TO IRREVERSIBLE CLIMATIC CHANGE OF THE GLOBAL ECOSYSTEM c46
In its The Future Environment 15 Jul. 1975 25 p refs (For availability see N76-18969 09-80)
CSCL 04A

The level, intensity, nature and impact of man's activities upon weather and climatic changes are explored. It is shown that industrialization leads to increased CO2 levels, atmospheric dust content and land surfaces changes. This in turn causes global climatic interactions which results in a general cooling trend. Global cooperation is advocated to stem environmental degradation and weather pattern interruption by the use of corrective mechanisms. G.G.

N76-18979* Forecasting International Ltd., Arlington, Va.
CONTINUING INFLATION LEADING TO EROSION OF PURCHASING POWER, UNEMPLOYMENT AND CONSTRAINT OF CAPITAL AVAILABILITY c83
In its The Future Environment 15 Jul. 1975 56 p refs (For availability see N76-18969 09-80)
CSCL 05C

The persistence of the current period of inflation and its apparent resistance to traditional fiscal and monetary policies implies a circular behavior that becomes increasingly impervious to ameliorative action. This behavior is attributed to: A concurrent

industrial boom among industrialized nations; price and production policies; worldwide reductions in agricultural products; international shortages of natural resources and raw materials; and rise in multinational firms and merchant banking. G.G.

N76-18980* Forecasting International Ltd., Arlington, Va.
NATIONAL AND INTERNATIONAL CAPITAL SHORTAGES SLOWING, PERHAPS PREVENTING, AMERICAN ECONOMIC GROWTH AND LEADING TO A DECLINE IN THE DOMESTIC STANDARD OF LIVING c83
In its The Future Environment 15 Jul. 1975 36 p refs (For availability see N76-18969 09-80)
CSCL 05C

It is shown that many of the basic industries that the U.S. has relied upon in the past for economic growth and development are now so obsolete, so old, and so technologically inferior to that of foreign competitors that the U.S. is losing its international competitive position. The most conservative estimate suggests that it will require $325 billion between now and 1982 merely to meet existing and currently anticipated pollution requirements and that it would take an additional $197 billion to replace outmoded existing facilities. Author

N76-18981* Forecasting International Ltd., Arlington, Va.
CONFLICT AND FEAR OVER THE IMPACTS OF SCIENCE AND TECHNOLOGY MAY RETARD, OR MAY HASTEN, SOCIETAL PROGRESS c85
In its The Future Environment 15 Jul. 1975 31 p refs (For availability see N76-18969 09-80)
CSCL 05K

Rapidly changing societal and individual values impact the course of man's future with accompanying conflict, tension and alienation. Conflict and fear over the impacts of science and technology may retard, or may hasten, societal progress. The broadening of the concept of equality of opportunity to an equality of outcome manifests itself by distributing the rewards of society based not on performance but simply on membership in the society. It is concluded that institutional failure caused by organizational and bureaucratic ineffectiveness inhibits change necessary for the solution of societal problems. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-18982# Federal Aviation Agency, Washington, D.C. Office of Systems Engineering Management.
AN EFFICIENCY STUDY OF THE EN ROUTE SYSTEM SUPPORT FACILITY Final Report
Carlo J. Broglio Oct. 1975 153 p
(AD-A019154/4; FAA-EM-75-9) Avail: NTIS HC $6.75 CSCL 09/2

An in-depth analysis is presented of the FAA's computer test facility at Atlantic City, New Jersey. The main objective was to improve the utilization efficiency of that facility. The study presents eleven problems of the current facility operation and presents twenty-four recommendations for solving these problems. The problems range from the lack of a clear definition of the facilities functional relationship, to the rest of the FAA's organization to a lack of proper software production and maintenance tools, to a hands-on form of operation. This data describe: some improved software test tools; a multi-computer operating system, a full description of an organizational structure for managing the facility, and an extensive discussion of scheduling techniques for the computer complex. Author

N76-18983# Yale Univ., New Haven, Conn. School of Organization and Management.
IMPROVING ORGANIZATIONAL COMMUNICATION THROUGH LONG-TERM INTERGROUP INTERVENTION
Clayton P. Alderfer Aug. 1975 37 p refs
(Contract N00014-67-A-0097-0017; NR Proj. 170-817)
(AD-A014904; TR-8) Avail: NTIS CSCL 05/10

The frequency, accuracy, and utility of communication among groups within organizations affects and is affected by their ethnocentricism. This study reports on the design, formulation, modification, and evaluation of a relatively new type of intergroup intervention--the creation of a 'microcosm group' of 12 members from an organization of 250 members. Charged with improving communication among work groups and hierarchical levels, the group was developed and maintained according to boundary and relationship concepts from open systems theory. It represented a microcosm of the system which it worked, addressed problems raised by both employees and management, assisted in a survey feedback intervention, survived concerns raised by the union, middle management, and leadership succession at the top of the organization. GRA

N76-18984# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN ANALYSIS OF GOVERNMENT/CONTRACTOR INTERACTION AS A MOTIVATOR OF CONTRACTOR PERFORMANCE M.S. Thesis
Jack R. Runkle and Gerald D. Schmidt Aug. 1975 99 p refs
(AD-A016034; SLSR-19-75B) Avail: NTIS CSCL 05/1

The purpose of this study was to determine whether influential government/contractor interaction can be used to focus top managements attention on contractual performance. The hypothesis states that a relationship exists between the formal structure of influential government/contractor interaction and documented contractor performance ratings. Data were collected at five NASA Centers and included 323 performance ratings on fifty-six contracts over a period of eight years. The data were tested for significant relationships using a stepwise linear regression model which considered the effects of organizational level and interaction frequency on the performance rating, in addition to nine other variables which potentially affected the performance rating. Author (GRA)

N76-18985# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
MODELING AND DECISION ANALYSIS Technical Report, 1 May 1973 - 31 May 1975
Steven Nobumasa Tani 30 Jun. 1975 147 p refs
(Contract N00014-67-A-0112-0077; ARPA Order 2449)
(AD-A016276; EES-DA-75-3) Avail: NTIS CSCL 05/1

The author uses mathematical modeling in decision analysis to help obtain a 'better' profit lottery than can be assessed directly. The concept of the authenticity of probabilities is introduced to define the measure of 'goodness' of the profit lottery. The role of modeling is to simplify the assessment task through the decomposition of the profit lottery. However, budgetary constraints force one to make approximations in the modeling process and thereby causes one to misstate the profit lottery. The models used in a decision analysis should be regarded as subjective expressions of uncertainty rather than as objective descriptions of the real-world. A methodology is presented that quantitatively relates the modeling approximations made in a decision analysis to the results of the analysis. GRA

N76-18986# Georgetown Univ., Washington, D.C. Inst. for Management Science and Engineering.
MINIMIZING THE COST OF SERVICING A PRODUCT SUBJECT TO AN EXPECTED COMPLETION TIME CONSTRAINT
James E. Falk and Marshall Rose 22 Aug. 1975 33 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A016028; Serial-T-321) Avail: NTIS CSCL 15/5

This paper describes a problem in which end products, such as aircraft, are periodically serviced, owing to the failure or preventive maintenance of repairable items. Given the required sequence of item reinstallations, the item resupply times, and item repair probabilities, a relation between the item resupply times and the expected end-product service time is derived. An exact algorithm designed to minimize the total cost of repair subject to a constraint on the expected service time is presented. A heuristic algorithm yielding the entire 'minimum cost per expected service time' curve is also described. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-18987*# D P Associates, Inc., Huntsville, Ala.
GENERAL PURPOSE SIMULATION SYSTEM OF THE DATA MANAGEMENT SYSTEM FOR SPACE SHUTTLE MISSION 18 Final Report
Neal M. Bengtson, Joseph M. Mellichamp, and Owen C. Smith 16 Jan. 1976 147 p refs
(Contract NAS8-31458)
(NASA-CR-144155) Avail: NTIS HC $6.00 CSCL 05B

A simulation program for the flow of data through the Data Management System of Spacelab and Space Shuttle was presented. The science, engineering, command and guidance, navigation and control data were included. The programming language used was General Purpose Simulation System V (OS). The science and engineering data flow was modeled from its origin at the experiments and subsystems to transmission from Space Shuttle. Command data flow was modeled from the point of reception onboard and from the CDMS Control Panel to the experiments and subsystems. The GN&C data flow model handled data between the General Purpose Computer and the experiments and subsystems. Mission 18 was the particular flight chosen for simulation. The general structure of the program is presented, followed by a user's manual. Input data required to make runs are discussed followed by identification of the output statistics. The appendices contain a detailed model configuration, program listing and results. Author

N76-18988*# National Academy of Sciences - National Research Council, Washington, D.C.
INFORMATION SERVICES AND INFORMATION PROCESSING Practical Applications of Space Systems
1975 38 p refs
(Contract NSR-09-012-106)
(NASA-CR-146278; Paper-13) Avail: NTIS HC $4.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 05B

Attempts made to design and extend space system capabilities are reported. Special attention was given to establishing user needs for information or services which might be provided by space systems. Data given do not attempt to detail scientific, technical, or economic bases for the needs expressed by the users. E.H.W.

N76-18989# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
AN INVESTIGATION OF THE REQUIREMENTS FOR BASE ENGINEERING AUTOMATED MANAGEMENT SYSTEM (BEAMS) PRODUCTS CURRENTLY GENERATED AND THEIR EFFECTIVENESS M.S. Thesis
Craig A. Birch and James N. Roberts Aug. 1975 172 p refs
(AD-A015967; SLSR-47-75B) Avail: NTIS CSCL 05/2

In 1968, Air Force Civil Engineering introduced the Base Engineer Automated Management System (BEAMS). This computerized system, designed to fulfill civil engineering managers' informational needs, now generates over 100 products. The purpose of this research was to determine which BEAMS products, if any, were not meeting the informational needs of these civil engineering managers. In particular, 26 BEAMS products which are specified for distribution to the Base Civil Engineer, the Chief of Programs, the Chief of Operations and Maintenance Branch, or the Industrial Engineer examined. Questionnaires were developed to obtain the opinions of these four managers. A random sample of these managers stationed within the contiguous United States was selected to participate in the survey. Civil engineering managers were generally satisfied with the 26 BEAMS products which were investigated. Four products were perceived as not useful by one category of civil engineering managers, Chiefs of Programs. Six products were perceived by either BCEs or Chiefs of Programs as not effective in at least one area. GRA

N76-18990# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TECHNICAL WRITING: ITS IMPORTANCE IN THE ENGINEERING PROFESSION AND ITS PLACE IN ENGINEERING CURRICULA. A SURVEY OF THE EXPERIENCE AND OPINIONS OF PROMINENT ENGINEERS Final Report
Richard M. Davis 9 Aug. 1975 87 p
(AD-A015906; AU-5-75-AFIT/EN) Avail: NTIS CSCL 05/2

A questionnaire was sent to prominent successful engineers to determine their experience with technical writing, their opinions about its importance to an engineer, and their opinions about its place in the engineering curriculum. The replies indicate that the respondents spend 24 percent of their time writing, that the writing that they do is very important to their positions, and that the ability to write effectively has helped them in their own advancement. They spend 31 percent of their time working with material written by others, are acutely conscious of the need for effective written communications, and find fault with many of the written communications with which they deal. They indicate that the ability to write is usually important or critical when a man is considered for advancement. GRA

N76-18991# Value Engineering Co., West Long Branch, N.J.
MULTI-CODED MICROFILM FEASIBILITY STUDY
R. W. Johnson and L. G. Volkheimer Aug. 1975 23 p refs
(Contract DAAA21-73-C-0639)
(AD-A015683; PA-TM-2187) Avail: NTIS CSCL 05/2

The objective of this analysis is to determine the feasibility of using a multi-coded microfilm on commercial hardware. The coded film includes Miracode (binary-coded microfilm), Document Mark (image count), and Bar (line) Code. The intention is to include as many as possible or all of the above codes on a single film so as to provide retrieval on virtually any system hardware. Of primary importance is determining the practicability of data retrieval of a multi-coded film on manually operated, motor-driven microfilm readers, as well as on various terminals. GRA

N76-18992# Westat Research, Inc., Rockville, Md. Research Div.
SCIENTIFIC SOCIETY MEMBERSHIP SURVEY: AVAILABILITY AND USE OF COMMUNICATION FACILITIES AND EQUIPMENT Final Report
Lois A. Green and Susan T. Hill Jan. 1975 85 p refs
(Contract NSF C-769)
(PB-243440/5; NSF/SIS-75-001-7) Avail: NTIS HC $5.00 CSCL 05B

Over 2,000 scientists in the physical and social sciences, mathematics and engineering were surveyed to establish an inventory of communication facilities and equipment available to scientists. Baseline estimates of awareness and usage of terminals and information retrieval systems are presented for each scientific field by the type of employing organization. Data are provided on the time interval between submission of their manuscripts and publication in scientific journals. The extent of use of journals directly and indirectly associated with the scientists' profession was also investigated. GRA

N76-18993# Applied Communication Research, Inc., Stanford, Calif.
THE DESIGN, PRODUCTION, DISTRIBUTION AND MAINTENANCE OF A PLANNING GUIDE TO BE ENTITLED GUIDE TO INNOVATION IN THE DISSEMINATION OF SCIENTIFIC AND TECHNICAL INFORMATION Final Report
R. H. Miller, J. M. Bleil, J. W. Corcoran, C. K. Mick, and M. Butler-Paisley 30 Mar. 1975 63 p
(Contract NSF C-951)
(PB-243438/9) Avail: NTIS HC $4.50 CSCL 05B

A prototype management planning guide to innovation in the dissemination of scientific and technical information is developed. The data acquisition, data processing, and preparation of the planning guide is covered. Accompanying the final report is a proposal for the production, distribution, and maintenance of the planning guide and associated innovation clearinghouse services is included. GRA

N76-18994# Institute for Defense Analyses, Arlington, Va. Cost Analysis Group.
AN ARMY LOGISTIC SUPPORT INFORMATION SYSTEM
Francis L. McDonald Mar. 1975 79 p refs
(Contract DAHC15-73-C-0200)
(AD-A016272; P-1110; IDA/HQ-75-17188) Avail: NTIS CSCL 15/5

This study provides an information system to be used by OASD/PA and E in obtaining data on a regular basis from Army logistic cost and workload reporting systems. These data will permit OASD/PA and E to maintain current the IDA-developed methodology for estimating Army central supply and maintenance resource requirements. This methodology was designed to be used in studies of defense resource allocations related to proposed alternative Army force structures. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-18995*# National Academy of Sciences - National Research Council, Washington, D.C.
COSTS AND BENEFITS Practical Applications of Space Systems
1975 85 p refs
(Contract NSR-09-012-106)
(NASA-CR-146276; Paper-11) Avail: NTIS HC $5.00; Space Applications Board, National Research Council, 2101 Constitution Avenue, N. W., Washington, D. C. 20418 CSCL 05C

Two models of cost benefit analysis are illustrated and the application of these models to assessing the economic scope of space applications programs was discussed. Four major areas cited as improvable through space derived information - food supply and distribution, energy sources, mineral reserves, and communication and navigation were - discussed. Specific illustrations are given for agriculture and maritime traffic. E.H.W.

N76-18996# Joint Economic Committee (U. S. Congress).
TECHNOLOGY, ECONOMIC GROWTH, AND INTERNATIONAL COMPETITIVENESS
Robert Gilpin Washington GPO 1975 90 p refs Rept. submitted to Subcomm. on Economic Growth of Joint Economic Comm., 94th Congr., 1st Sess., 9 Jul. 1975 Prepared by Princeton Univ.
(GPO-53-938) Avail: SOD HC $1.10

The relationships between technology, economic growth, and international competitiveness were investigated. A general conclusion is that technology policy must be coupled with socio-economic policy. While in theory this is easy to do, in practice it is exeptionally difficult because of institutional commitments and lack of sufficient knowledge. Examples were given from the United States, Great Britain, France, Germany, and Japan. The following areas were discussed: (1) the primacy of demand-pull over technology-push, (2) the central importance of uncertainty, (3) the proper role of government R and D funding, (4) the question of institutional mechanisms, (5) a national strategy for science and technology. Y.J.A.

N76-18997# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF OPTIMUM CAPITAL EXPENDITURES DURING THE DESIGNING OF AN ASU
V. V. Lobanov, S. V. Kozachenko, and L. S. Lobanova 9 May 1975 12 p Transl. into ENGLISH from Tekh. Organ. Proizvod. (USSR), no. 1, 1972 p 4-5
(AD-A016144; FTD-ID(RS)I-1319-75) Avail: NTIS CSCL 13/8

The report discusses selecting the optimum capital expenditures in the creation of an automatic control system. GRA

N76-18998# Naval Training Equipment Center, Orlando, Fla. Training Analysis and Evaluation Group.
ACQUISITION COST ESTIMATING USING SIMULATION Final Report
Henry C. Okraski and William F. Parrish, Jr. Sep. 1975 31 p refs
(AD-A015624; TAEG-TM-75-4) Avail: NTIS CSCL 15/5

Acquisition cost estimates developed as single point values are, at best, misleading and, at worst, impossible to achieve. Single point estimates do not sufficiently reflect the assumptions, judgment or apprehensions of the estimator. This paper deals with a technique for incorporating uncertainty and risk into the acquisition cost estimating procedure such that the estimates are presented as a range of values, encompassing engineering, manufacturing and logistic support estimates. The cost estimating model, a pragmatic application of simulation and classical cost estimating precedures, has been programmed in BASIC and is generalizable and exportable. GRA

N76-18979* Forecasting International Ltd., Arlington, Va.
CONTINUING INFLATION LEADING TO EROSION OF PURCHASING POWER, UNEMPLOYMENT AND CONSTRAINT OF CAPITAL AVAILABILITY
In its The Future Environment 15 Jul. 1975 56 p refs (For availability see N76-18969 09-80)
CSCL 05C

N76-18980* Forecasting International Ltd., Arlington, Va.
NATIONAL AND INTERNATIONAL CAPITAL SHORTAGES SLOWING, PERHAPS PREVENTING, AMERICAN ECONOMIC GROWTH AND LEADING TO A DECLINE IN THE DOMESTIC STANDARD OF LIVING
In its The Future Environment 15 Jul. 1975 36 p refs (For availability see N76-18969 09-80)
CSCL 05C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-18999# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977, VOLUME 1, PART 1
Washington GPO 1975 1406 p Hearings on H.R. 11573 before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 1st and 2d Sessions, No. 33, 13-17 Oct.; 6 Nov., 11-13 Nov., and 18 Nov. 1975
(GPO-63-169) Avail: Subcomm. on Space Sci. and Applications

Various NASA programs are reviewed in terms of the budget for FY 1977. Topics discussed include: the space transportation system; unmanned planetary missions; large space telescope; communication satellites; remote sensing; satellite solar power; stratospheric ozone; energy applications of aerospace technology; and tracking and data acquisition network. J.M.S.

N76-19000# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1977, VOLUME 2, PART 1
Washington GPO 1976 533 p refs Hearings on H.R. 11573 before Subcomm. on Aviation and Transportation R and D of Comm. on Sci. and Technol., 94th Congr., 1st and 2d Sessions, No. 34, 4-5 Nov., 15-16 Oct., 3 and 10 Nov. 1975
(GPO-64-383) Avail: Subcomm. on Aviation and Transportation R and D

The NASA budget for FY 1977 is considered. Emphasis is placed on programs relating to air transportation and aviation. Topics discussed include: life-fan technology; improvements in rotary wing systems; reduction of engine noise and emissions; microwave landing system; and development of fire resistant materials and aviation safety. J.M.S.

N76-19001# Committee on Interior and Insular Affairs (U. S. Senate).
OUTER CONTINENTAL SHELF MANAGEMENT ACT OF 1975
Washington GPO 17 Jul. 1975 119 p ref Rept. to accompany S. 521, 94th Congr., 1st Sess., 17 Jul. 1975
(S-Rept-94-284) Avail: US Capitol, Senate Document Room

Outer continental shelf (OSC) management legislation is described which would (1) establish policy guidelines, (2) require a 5-year leasing program, (3) give the coastal states an increased role in Federal OCS decisions, (4) provide Federal compensation to coastal states adversly affected by OCS development, (5) improve safety requirements, (6) establish unlimited absolute liability for oil spill damage with payments from a liability fund, (7) provide for a two-step decision process to separate exploration from development and production, and (8) authorize new leasing systems and require their use on an experimental basis. Author

N76-19002# Committee on Appropriations (U. S. House).
DEPARTMENT OF TRANSPORTATION AND RELATED AGENCIES APPROPRIATIONS FOR 1976. PART 5: DEPARTMENT OF TRANSPORTATION (URBAN MASS TRANSPORTATION ADMINISTRATION, OFFICE OF THE SECRETARY); TESTIMONY OF MEMBERS OF CONGRESS AND INTERESTED INDIVIDUALS AND ORGANIZATIONS
Washington GPO 1975 1011 p refs Hearings before a Subcomm. of the Comm. on Appropriations, 94th Congr., 1st Sess., 5 May 1975
(GPO-53-425) Avail: Comm. on Appropriations

Budget requests of the Urban Mass Transportation Administration are reviewed. Topics discussed include transportation legislation, transit planning, capital assistance, transit management, financial management of transportation systems, administrative expenses, and transportation research and development.
M.J.S.

N76-19003# Joint Committe on Atomic Energy (U. S. Congress).
DEVELOPMENT, USE, AND CONTROL OF NUCLEAR ENERGY FOR THE COMMON DEFENSE AND SECURITY AND FOR PEACEFUL PURPOSES
Washington GPO 1975 109 p refs Annual rept. by Joint Comm. on Atomic Energy pursuant to Section 202(B) of the Atomic Energy Act, as amended, 94th Congr., 1st Sess., 17 Jul. 1975
(H-Rept-94-366; GPO-55-727; AR-1) Avail: US Capitol, House Document Room

The problems of nuclear proliferation, growing Soviet nuclear capability, the security of U.S. nuclear weapons deployed abroad, and safeguarding against nuclear related terrorism are discussed.
D.M.L.

N76-19004# Committee on Interstate and Foreign Commerce (U. S. House).
ENERGY CONSERVATION AND OIL POLICY ACT OF 1975
Washington GPO 1975 325 p refs Rept. together with minority, supplemental, and additional views to accompany H.R. 7014, 94th Congr., 1st Sess., 9 Jul. 1975
(H-Rept-94-340; GPO-57-006) Avail: US Capitol, House Document Room

A bill is proposed which is directed to the attainment of the collective goals of increasing domestic supply, conserving and managing energy demand, and establishing standby programs for minimizing the nation's vulnerability to major interruptions in the supply of petroleum imports. The bill would apply price controls to the entirety of domestic crude oil production in an attempt to restore elements of reason to a marketplace whose mechanisms are made to counteract the influence of cartel pricing and to insulate the economy at least in part fro: . further sharp inflationary increases in petroleum prices. The bill would also establish regulatory programs to bring about measured savings in consumption of energy by improving the efficiency of products and cars. Targeted goals for bettering industrial efficiencies are provided. And a gasoline savings program is established which makes use of allocation and supply controls to prevent growth in gasoline consumption over the next three years and, where practicable, to reduce existing demand levels by an additional 2 to 4 percent. The bill's main provisions are discussed in detail.
Author

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-19005 Portland State Univ., Oreg.
A NEW INQUIRING SYSTEM FOR TECHNOLOGY TRANSFER AND ITS ROLE IN PLANNING AND POLICYMAKING Ph.D. Thesis
Kishandutt Jaydayal Sharma 1973 232 p
Avail: Univ. Microfilms Order No. 76-2960

An inquiring system for technology transfer which emphasizes a multidimensional viewpoint of the technology transfer process is developed. Topics discussed include: (1) a hierarchical structure for examining the technology tranfer problem; (2) measures for assessing the performance of technology transfer; and (3) a demonstration example of the suggested methodology. Special emphasis is placed on the needs of planners and policymakers who are considered the clients of the proposed inquiring systems.
Dissert. Abstr.

N76-18974* Forecasting International Ltd., Arlington, Va.
CONTINUED URBANIZATION OF THE UNITED STATES IS CAUSING THE DETERIORATION OF THE CENTRAL CITY; COSTLY SUBURBAN DEVELOPMENTS; AND INCREASES IN CONGESTION, POLLUTION, CRIME, VIOLENCE AND ALIENATION
In its The Future Environment 15 Jul. 1975 30 p refs (For availability see N76-18969 09-80)
CSCL 05K

N76-18981* Forecasting International Ltd., Arlington, Va.
CONFLICT AND FEAR OVER THE IMPACTS OF SCIENCE AND TECHNOLOGY MAY RETARD, OR MAY HASTEN, SOCIETAL PROGRESS
In its The Future Environment 15 Jul. 1975 31 p refs (For availability see N76-18969 09-80)
CSCL 05K

88 SPACE SCIENCES (GENERAL)

N76-19006*# National Aeronautics and Space Administration, Washington, D.C.
NASA AND THE NOW SYNDROME
1975 11 p
(NASA-TM-X-72918) Avail: NTIS HC $3.50 CSCL 05A

After a brief review of the space exploration programs, the future options in space are discussed.
F.O.S.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-19007 Colorado Univ., Boulder.
THE LOWER CHROMOSPHERE AND UPPER PHOTOSPHERES OF LATE-TYPE STARS Ph.D. Thesis
Thomas Russell Ayres 1975 208 p
Avail: Univ. Microfilms Order No. 76-3882

High dispersion, well calibrated profiles of Ca 2 K, Mg 2 h and k, and H are interpreted in five late-type stars, including the sun, by constructing plane-parallel, hydrostatic atmospheric models and synthesizing spectra using a partial redistribution formalism. In the empirical data there is a strong correlation between the widths of the K sub 1 inner wing minimum features

and luminosity, analogous to the Wilson-Bappu effect obeyed by the Ca 2 and Mg 2 emission half-widths. It is shown qualitatively that this behavior of the K sub 1 features would be expected if the continuum optical depth of the stellar temperature minimum is relatively independent of surface gravity, and support this conjecture by detailed modeling of the temperature minimum regions of the five program stars.
Dissert. Abstr.

N76-19008 California Univ., San Diego.
OBSERVATIONS OF INTERPLANETARY SCINTILLATIONS AT 74 MEGAHERTZ Ph.D. Thesis
John William Armstrong 1975 186 p
Avail: Univ. Microfilms Order No. 76-2292

Interplanetary scintillations (IPS) at 74 MHz, observed during 1971-1974, were analyzed with the aims of (1) relating the IPS variance and third statistical moment to physical properties of the radio source and the solar wind, and (2) using IPS-determined solar wind velocity spectra to study velocity fluctuations on time scales of 0.5-6 minutes and 2-100 days. The annual maximum value of the IPS rms flux decreased by 39 percent during 1971.4-1974.6. Total 74 MHz flux was determined as a function of time. The skewness parameter was also measured. Solar wind velocity spectra in the 0.003-0.03 Hz band revealed no significant variations. For velocity spectra in the band 0.01-0.5 cycles/day, the velocity variance and degree of correlation after one solar rotation lag varied strongly with time while the mean solar wind velocity did not. Systematic differential rotation of the solar wind with heliographic latitude was not indicated.
Dissert. Abstr.

N76-19009 Arizona Univ., Tucson.
T TAURI STARS Ph.D. Thesis
Alfred Eric Rydgren, Jr. 1975 167 p
Avail: Univ. Microfilms Order No. 76-3798

Spectroscopic and photometric (optical and infrared) observations of T Tauri stars in the Taurus and Rho Oph clouds are presented. A model is proposed in which a late-type star is surrounded by a hot (approximately 20,000 K) gaseous envelope. The envelope accounts for the emission lines, the spectral veiling, and most of the true infrared excess, while temporal changes in the strength of the envelope emission appear to be the principal source of irregular light variations. Reliable bolometric luminosities were obtained which, together with effective temperatures, indicate that they are relatively low mass stars evolving toward the main sequence along quasi-state equilibrium tracks. Masses of less than 3 solar masses and ages generally less than 1 million were inferred from a comparison with theoretical evolutionary tracks. Evidence indicates that the mass-loss rate and envelope emission strength decrease with time during the T Tauri phase. It is suggested that the T Tauri phenomenon corresponds to a phase of rapid angular momentum loss in convective protostars.
Dissert. Abstr.

N76-19010 Harvard Univ., Cambridge, Mass.
INFRARED EMISSION FROM GALACTIC HII REGIONS Ph.D. Thesis
Michael Zeilik, II 1975 120 p
Avail: Univ. Microfilms Order no. 76-4473

Near infrared observations of galactic HII regions were made and dust models were then developed to match the characteristics of the observed 2-25 micron emission. The dust consists of silicate and graphite grains. The silicates have their cosmic maximum abundance with respect to hydrogen but the graphite grains are depleted by factors of 25-100 in mass. Lyman-alpha radiation predominately heats the silicate grains, which produce almost all the emission at 20 microns and most of it from 8-13 microns. Stellar radiation predominately heats the graphite grains, which generate most of the emission at 3.5 and 5 microns. Roughly half of the observed 2-25 micron luminosity arises from Lyman-alpha photons and the other half from the Lyman and Balmer continua. This model predicts that HII regions should have smaller sizes at 3.5 and 5 microns than at 10 and 20 microns.
Dissert. Abstr.

N76-19011 Indiana Univ., Bloomington.
SPECTROPHOTOMETRY OF CARBON STARS Ph.D. Thesis
Charles Edward Gow 1975 314 p
Avail: Univ. Microfilms Order No. 76-2821

Observations of carbon stars were made in the red and, when possible, in the visual and blue regions of the spectrum. Five distinct subtypes of carbon stars (Barium, CH, R, N, and hydrogen deficient) were represented. From the scanner data, it was possible to derive a color temperature for the yellow-red spectral region by fitting a black-body curve through two chosen continuum points. Photometric indices were calculated relative to the blackbody curve to measure the C2 Swan band strength, the shape of the CN red (6.1) band to provide a measure of the C12/C13 isotope ratio, and in the hot carbon stars (Barium, CH, and R stars), the strength of an unidentified feature centered at 400 angstroms. As an aid interpreting the observations of the hot carbon stars, an abundance grid of model atmospheres was calculated.
Dissert. Abstr.

N76-19012 Colorado Univ., Boulder.
AN EMPIRICAL STUDY OF CHROMOSPHERIC FINE STRUCTURE BASED ON SIMULTANEOUS SPECTROGRAMS IN THE H, K, 8498 A AND 8542 A LINES OF CaII Ph.D. Thesis
Douglas Ross Brown 1975 346 p
Avail: Univ. Microfilms Order No. 76-3889

High resolution spectrograms were obtained with the Vacuum Tower Telescope at Sacramento Peak Solar Observatory in the H alpha line, NaI D lines, CaII K, H, 8498 A and 8542 A lines in absolute simultaneity, as well as K line and continuum slit jaw images. The data include quiet and plage regions near disk center, and quiet center to limb sequences. Spatial resolution ranged between 0.5 and 1.5 arc seconds. From this data, two sets of CaII spectrograms were selected from the quiet sun and plage time sequences and the fine structure profiles identified using the K index. Statistical and visual methods are used to define 4 plage and 6 quiet sun fine structure classes.
Dissert. Abstr.

N76-19013 Harvard Univ., Cambridge, Mass.
THE STRUCTURE OF PLANETARY NEBULAE Ph.D. Thesis
Larry Edward Goad 1975 133 p
Avail: Univ. Microfilms Order No. 76-4474

Image-tube photographs of three planetary nebulae were taken through narrow-band interference filters to map the surface-brightness of the nebulae in their most prominent emission lines. A two-component model consisting of a tenuous diffuse nebular medium and a network of dense knots and filaments with neutral cores was used to explain the observations. The observations of the diffuse component indicate that the inner regions of these nebulae are hollow shells. This suggests that steady stellar winds are the dominant factor in determining the structure of the central regions of planetary nebulae. The observations of the filamentary components of NGC 40 and NGC 6720 show that the observed nebular features can result from the illumination of the inner edges of dense fragmentary neutral filaments by the central stars of these nebulae. From the analysis of the observations of the low-excitation lines in NGC 2392, it was concluded that the rate constant for the N+ H charge transfer reaction is less than 10 to the minus 12th power cubic centimeters/second.
Dissert. Abstr.

N76-19014 Iowa Univ., Iowa City.
RADIOASTRONOMICAL OBSERVATION OF UV CETI STARS Ph.D. Thesis
Steven Randall Spangler 1975 156 p
Avail: Univ. Microfilms Order No. 76-2186

The UV Ceti-type stars V371 Ori, YZ CMi, AD Leo, Wolf 424, BD + 16 deg 2708, Ross 867, G25-16, EQ Peg, and G3-33 were monitored in the time period October 20, 1973 to August 5, 1974. The decimetric wavelength observations may be categorized as radiometry, polarimetry, simultaneous optical-radio observations, and a search for long time scale variations. More than 70 flare events were observed during the project. There appear to be two classes of events based on flare duration: (1) impulsive events with half power durations ranging from a few seconds to 1 or 2 min, and (2) longer duration flares with half power durations of 10 min or longer. Observed amplitudes for both classes of events at 430 MHz ranged from the detection

limit of a few hundredths of a flux unit to 0.6 flux units. Rates of occurrence of impulsive events are comparable to optical detection rates. Spectral indices derived from simultaneous observations at 318 and 196 MHz tend to be strongly nonthermal with a range of -1.3 to -7.2. Dissert. Abstr.

N76-19015*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
THE SEARCH FOR THE CAUSE OF THE LOW ALBEDO OF THE MOON
T. Gold, E. Bilson, and R. L. Baron [1975] 59 p refs
(Grants NGL-33-010-005; NGR-33-010-137)
(NASA-CR-146318; CRSR-625) Avail: NTIS HC $4.50 CSCL 03A

Experimentation concerning lunar weathering and its effect on the albedo of the surface cover consisted of: (1) determination of the surface chemical composition of lunar soil and ground-up rock samples by Auger electron spectroscopy, (2) measurement of the optical albedo of these samples, and (3) proton or alpha-particle irradiation of terrestrial rock chips and rock powders and of ground-up lunar rock samples in order to determine the optical and surface chemical effect of simulated solar wind. Author

N76-19016*# California Inst. of Tech., Pasadena.
DESIGN AND CONSTRUCTION OF PROTOTYPE RADIO ANTENNA FOR SHORTEST RADIO WAVELENGTHS Final Technical Report
Robert B. Leighton [1975] 25 p
(Grant NGL-05-002-007)
(NASA-CR-146304) Avail: NTIS HC $3.50 CSCL 03A

A paraboloid radio antenna of 10.4 meters diameter, 0.41 meter focal length was constructed and its successful completion is described. The surface accuracy of the antenna is at least four times better than any existing antenna in its class size (50 micrometers rms). Antenna design specifications (i.e., for mounting, drive motors, honeycomb structures) are discussed and engineering drawings and photographs of antenna components are shown. The antenna will be used for millimeter-wave interferometry and sub-millimeter wave radiometry over a full frequency range (up to approximately 860 GHz). The antenna will also be moveable (for interferometric use) between reinforced concrete pads by rail. The effects of the weather and gravity on antenna performance are briefly discussed. J.R.T.

N76-19017*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
DETERMINATION OF THE LIGHT ION ABUNDANCES IN THE STRONG-HELIUM STAR HR 3089 Final Report, 1 Oct. 1974 - 31 Dec. 1975
John B. Lester 31 Dec. 1975 37 p refs
(Grant NsG-5028)
(NASA-CR-146323) Avail: NTIS HC $4.00 CSCL 03A

Using line blanketed model stellar atmospheres and a spectrum synthesis approach, a differential abundance study of the ultraviolet spectrum of HR 3089 relative to the normal star lambda Sco was performed. Both stars were found to have the same abundances of carbon and silicon, but the helium and nitrogen are significantly enhanced in HR 3089. The atmospheric parameters and the distribution of abundances found for HR 3089 agree well with the results of Osmer and Peterson on sharp-lined helium-rich stars. The rotational velocity of 160 km/sec found for HR 3089 places a constraint on the role of diffusion in producing the abundance anomalies. Examination of the resonance lines of C II, N II, Si III and Si IV shows no evidence for mass loss in either star. Author

N76-19018*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL FOR THE X-RAY NOVA A0620-00
A. S. Endal, E. J. Devinney, and S. Sofia Mar. 1976 18 p refs Submitted for publication
(NASA-TM-X-71074; X-671-76-42) Avail: NTIS HC $3.50 CSCL 03A

The model involves a white dwarf accreting mass from a late-type subgiant companion. The transient behavior of the X-ray source is explained by the instability to mass loss of the companion (as in Algol-type binaries). The brightening, spectrum, and decay timescale of the optical counterpart are explained in terms of re-emission of X-radiation intercepted by the subgiant. It was concluded that A0620-00 can provide an excellent test case for numerical models of stellar atmospheres irradiated by an external X-ray flux. Author

N76-19019*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
STUDIES IN SUPPORT OF THE ANALYSIS OF ASTRONOMICAL DATA FROM APOLLO 16 Final Technical Report, 1 Dec. 1974 - 31 Aug. 1975
K. I. Greisen Mar. 1976 33 p refs
(Grant NsG-5037)
(NASA-CR-146430; CRSR-628) Avail: NTIS HC $4.00 CSCL 03A

The Apollo Gamma Ray Spectrometer which was part of the scientific instrument module aboard Apollo 16 obtained more than 20 hours of astronomical data near the end of the transearth coast phase of the mission. During this time the vehicle was maneuvered so that every part of the sky as seen by the spectrometer was eventually occulted by the spacecraft, providing a valuable data base for gamma ray astronomy in the 100 keV to 5 MeV spectral range. Schemes classified according to the underlying assumed source distribution are analyzed. It is known that there is at least one point source, the Crab, and it can be seen in the data. Methods for data analysis are shown. In one method looking only for point sources, some preliminary results concerning the Crab nebula are presented which confirm previous measurement of the strength of that source. Author

N76-19020# Naval Academy, Annapolis, Md.
OBSERVATION AND SOLUTION OF THE LIGHT CURVE FOR A W URSAE MAJORIS ECLIPSING BINARY STAR SYSTEM
Bruce E. Miller 23 May 1975 131 p refs
(AD-A015957; USNA-TSPR-70) Avail: NTIS CSCL 03/1

This project has approached the study of eclipsing binary star systems from both the observational and the theoretical stand points. Observations of eclipsing binary stars U Pegasi and AZ Virginis of the W Ursae Majoris contact binary type have been made. The method for solving an eclipsing binary system's light curve for the system's elements (the radii, luminosity and limb darkening coefficients of the component stars and the inclination of the orbital plane) - originally developed by Thomas B. Horak - has been programmed for an electronic computer. Details and proceedings are described. After some modification, Horak's method for solving the light curve is shown to be at least as accurate as the classical methods and yet vastly superior to previous approaches in the speed and ease with which a solution may be obtained. A solution for the recently observed binary system VW Bootis is also obtained which appears superior to the only previous solution. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-19021 Arizona Univ., Tucson.
BEAM FOIL STUDY OF ATOMIC SPECTRA AND MEAN LIVES OF ASTROPHYSICAL INTEREST Ph.D. Thesis
Ming-Wen Chang 1975 122 p
Avail: Univ. Microfilms Order No. 76-2542

The beam-foil technique was used to study the atomic spectra and mean lives of rocket- and satellite-acquired spectral data in astrophysical applications. Accuracy in spectral line identification was increased by using a theory of beam-foil spectral line profiles which takes into consideration exponential decay, the main factor of the beam-foil spectral line profile. The line peak was used to extract the proper wavelength. The accuracy of mean-life measurements was improved by averaging over different foil thickness, the foil-aging effect, and beam fluctuations, as well as by smoothing techniques. A computerized data acquisition technique was also developed. The effect of incomplete channels in beam-foil data was investigated, it was concluded that in some previous measurements involving fast decays, the effect

was quite severe and could contribute to incorrect mean life values. Dissert. Abstr.

N76-19022 Yeshiva Univ., New York.
FORMATION OF GIANT PLANETS Ph.D. Thesis
Fausto Perri 1975 72 p
Avail: Univ. Microfilms Order No. 76-4550

When a planet core composed of condensed matter is accumulated in the primitive solar nebula, the gas of the nebula becomes gravitationally concentrated as an envelope surrounding the planetary core. Models of such gaseous envelopes were constructed subject to the assumption that the gas everywhere is on the same adiabat as that in the surrounding nebula. The gaseous envelope extends from the surface of the core to the distance at which the gravitational attraction of core plus envelope becomes equal to the gradient of the graviational potential in the solar nebula; at this point the pressure and temperature of the gas in the envelope are required to attain the background values characteristics of the solar nebula. In general, as the mass of the condensed core increases, increasing amounts of gas become concentrated in the envelope, and these envelopes are stable against hydrodynamic instabilities. Dissert. Abstr.

N76-19023 State Univ. of New York, Albany.
A UNIFIED MODEL OF INTERSTELLAR GRAINS Ph.D. Thesis
Seung Soo Hong 1975 134 p
Avail: Univ. Microfilms Order No. 76-1899

On the basis of a very simple analytical approximation for the forward scattering amplitude function, unified interpretation is given to the observed inter-relationship between the wavelength dependences of interstellar extinction, and linear and circular polarization. Thus these three key observations are timed intimately to each other by the classical theory of light scattering. An interstellar grain model is proposed to explain simultaneously such basic observations. The model is composed of two populations: core-mantle particles in 0.1 micron size range, and very small uncoated particles generally less than 0.01 micron in size. The composition of the core-mantle particle is inferred from the observations of infrared absorption bands; the cores consist of silicate, and the mantles are a solid mixture of oxygen, carbon and nitrogen with hydrogen. Theoretical extinction, and linear and circular polarization curves based on the core-mantle bimodal grain model have been directly compared with the corresponding observations. Dissert. Abstr.

N76-19024*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STRONG SCINTILLATIONS IN ASTROPHYSICS. 4. CROSS-CORRELATION BETWEEN DIFFERENT FREQUENCIES AND FINITE BANDWIDTH EFFECTS
L. C. Lee Feb. 1976 29 p refs Submitted for publication
(NASA-TM-X-71072; X-602-76-35) Avail: NTIS HC $4.00 CSCL 03B

The cross correlation of the intensity fluctuations between different frequencies and finite bandwidth effects on the intensity correlations based on the Markov approximation were calculated. Results may be applied to quite general turbulence spectra for an extended turbulent medium. Calculations of the cross-correlation function and of finite bandwidth effects are explicitly carried out for both Gaussian and Kolmogorov turbulence spectra. The increases of the correlation scale of intensity fluctuations are different for these two spectra and the difference can be used to determine whether the interstellar turbulent medium has a Gaussian or a Kolmogorov spectrum. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-19025*# Oak Ridge National Lab., Tenn.
SEARCH FOR AND ANALYSIS OF RADIOACTIVE HALOS IN LUNAR MATERIAL Final Report
Robert V. Gentry [1976] 6 p refs
(NASA-CR-147462; NASA Order T-1213A) Avail: NTIS HC $3.50 CSCL 03B

The lunar halo search was conducted because halos in terrestrial minerals serve as pointers to localized radioactivity, and make possible analytical studies on the problems of isotopic dating and mode of crystallization of the host mineral. Ancillary studies were conducted on terrestrial halos and on certain samples of special origin such as tektites and meteorites. Author

N76-19026*# Transemantics, Inc., Washington, D.C.
MINERALOGY, STRUCTURE AND PARAGENESIS OF THE PRODUCTS OF GUTTOGENESIS DUE TO NATURAL AERODYNAMIC ABLATION OF SIDERITIC METEORITES
B. Baldanza and F. Rondelli Washington NASA Feb. 1976 29 p refs Transl. into ENGLISH from Period. Mineral. (Italy), v. 41, no. 3, 1972 p 539-563
(Contract NASw-2792)
(NASA-TT-F-16876) Avail: NTIS HC $4.00 CSCL 03B

During atmospheric entry at high velocities, meteorites experience severe aerodynamic heating and ablation of a thin melted layer that first forms on the front surface, and later extends as a fusion crust. Tiny droplets, slags, globules and dabs are sprayed to form meteor dust. A search for the magnetic portion of such dust was performed. Information on mineralogy, chemistry, structure and texture, and paragenesis of the recovered material was gained. Author

N76-19027*# Transemantics, Inc., Washington, D.C.
PHOTOGRAPHIC CHARACTERISTICS OF MARS ACCORDING TO DATA OF PHOTOGRAPHIC OBSERVATIONS DURING THE GREAT OPPOSITION OF 1971
A. R. Gayduk, N. B. Ibragimov, and I. K. Koval NASA Feb. 1976 161 p refs Transl. into ENGLISH of the book "Fotometricheskiye Kharakteristiki Marsa po Dannym Fotograficheskikh Nablyudeniy v Period Velikogo Protivostoyania, 1971" Kiev, Naukova Dumka Press, 1975 p 3-128
(Contract NASw-2792)
(NASA-TT-F-16693) Avail: NTIS HC $6.75 CSCL 03B

The method and results of photometry of photographs of Mars are presented which were obtained with interference light filters in the Kude focus of the two-meter telescope of the Shemakhinsk Astrophysical Observatory during the great opposition of 1971. Photometric charts of Mars were plotted for six narrow regions of the visible and near-ultraviolet regions of the spectrum. The contrasts of details of the Martial surface were determined from them. The results of absolute spectral observations of the central continent region of the Martian disk and the characteristics of the marginal violet clouds which were observed in August of 1971 are presented. Author

N76-19028*# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
COMPARISON OF A MODEL OF JUPITER'S MAGNETOSPHERE WITH PIONEER DATA
A. Prakash 20 Aug. 1975 15 p refs
(Grant NsG-7135)
(NASA-CR-146421) Avail: NTIS HC $3.50 CSCL 03B

A model of Jupiter's magnetosphere in which there is a circum-Jovian outflow of plasma from an inner corotating magnetodisc is compared with the observations of the Pioneer flybys. Author

N76-19029*# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
CURRENT STATUS OF MODELS OF JUPITER'S MAGNETOSPHERE IN THE LIGHT OF PIONEER DATA
A. Prakash and Peter Auer 1975 25 p refs
(Grant NsG-7135)
(NASA-CR-146425; LPS-178) Avail: NTIS HC $3.50 CSCL 03B

The salient features of the various models of Jupiter's magnetosphere are compared with each other and with the major findings of Pioneer 10 and 11. No single model explains all the

major phenomena detected by the Pioneers. A unified model of Jupiter's magnetosphere is proposed. Author

N76-19030*# National Aeronautics and Space Administration, Washington, D.C.
REPORTS OF ACCOMPLISHMENTS OF PLANETOLOGY PROGRAMS, 1975 - 1976
Mar. 1976 282 p refs
(NASA-TM-X-3364) Avail: NTIS HC $9.25 CSCL 03B

Abstracts of reports which summarize work conducted by Planetology Program Principal Investigators are presented. Full reports of selected abstracts were presented to the annual meeting of Planetology Program Principal Investigators at the Center for Astrogeology, U.S. Geological Survey, Flagstaff, Arizona, March 8, 9, 19, 1976. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-19031 Colorado Univ., Boulder.
AN OBSERVATIONAL INVESTIGATION OF THE SOLAR OBLATENESS Ph.D. Thesis
Robin Tucker Stebbins 1975 170 p
Avail: Univ. Microfilms Order No. 76-3955

Solar oblateness observations were attempted with improved experimental techniques, including a daytime astrometric telescope and an explicit definition of the edge of the sun. When applied with the SCLERA telescope, this finite Fourier transform definition enables the sun's edge to be located to arc millisecond accuracies. Observations revealed a time varying excess equatorial brightness, that is, a variation in the limb darkening function between equator and pole, which would preclude accurate interpretation of previous solar oblateness measurements. During a time when the excess brightness was markedly reduced, the equatorial diameter was found to be 18.4 + or - 12.5 arc msec larger than the polar diameter. This value of the solar oblateness agrees well with the 15.7 arc msec predicted if the entire sun uniformly rotates at the synodic rate. Dissert. Abstr.

N76-19032 Colorado Univ., Boulder.
SOME EFFECTS OF SOLAR ACTIVITY IN THE EARTH'S MIDDLE ATMOSPHERE Ph.D. Thesis
John Eugene Frederick 1975 263 p
Avail: Univ. Microfilms Order No. 76-3902

The role of solar activity in controlling minor neutral constituent concentrations in the earth's middle atmosphere (30-90 km) was investigated. Solar emissions considered important for this study were ultraviolet particles, prynorilis protons ejected for large solar flares. A method is described for computing atmospheric ionization and dissociation rates due to energetic proton bombardments. The dissociation of N2 provides a source of atomic nitrogen in the high latitude middle atmosphere which leads to an increase in nitric oxide. In addition other ions are formed into water clusters, i.e., H3O(+)(H2O), which liberate neutral atomic hydrogen upon recombination with electrons and negative ions. The most significant effect associated with solar electromagnetic variations is the change in mesospheric ozone. This is due largely to hydrogen production by the action of Lyman alpha radiation on water vapor. In addition, nitrogen and hydrogen production in solar proton events leads to the destruction of ozone. Dissert. Abstr.

N76-19033 California Univ., Davis.
A THEORETICAL STUDY, EFFECT OF AEROSOLS ON SOLAR RADIATIVE HEATING IN THE ATMOSPHERIC BOUNDARY LAYER Ph.D. Thesis
Paul Halpern 1975 149 p
Avail: Univ. Microfilms Order No. 76-1787

The effects of particulate pollutants on the shortwave heating rates in the atmospheric boundary layer (0-2 km) were evaluated using four different computational methods: the exact Gauss-Seidel iteration, by which all orders of scattering are accounted for, and the three approximations of primary scattering, no scattering, and median wavelength. The radiative transfer equation is solved for a plane parallel atmosphere of infinite extent in the horizontal but of finite in the vertical. Simulations using representative particle number density variations with height and typical aerosol models of composition and size distribution were made. The analysis of these results obtained using the exact Gauss-Seidel iteration method indicates that the spectrally integrated flux divergence is highly dependent on: solar zenith angle, total number of particles and imaginary value of the aerosol refractive index. The effect of gaseous absorption, however, appears to have a smaller influence on the flux divergence. Dissert. Abstr.

N76-19034 State Univ. of New York, Albany.
SOLAR FLARE EFFECTS ON THE ZODIACAL LIGHT Ph.D. Thesis
Nebil Yousif Misconi 1975 192 p
Avail: Univ. Microfilms Order No. 76-4611

An observational and theoretical study was carried out of possible solar flare effects on the zodiacal light. A total of 38 nights (February, March and April 1966, March 1967, and March 1968) of ground based observations, which were taken from Mt. Haleakala, Hawaii by Weinberg, were searched for solar flare effects. No changes were found in the shape of the main cone of the zodiacal light at elogations > 23 degrees. Dynamical processes affecting the dust particle's heliocentric orbit were considered in relation to brightness changes. Fluorescence of the dust particles was found to be unimportant. The increased ion drag with respect to the Poynting-Robertson drag under shock conditions was found to increase considerably only at heliocentric distances < 0.1 A.U. and therefore can not cause a birghtness change beyond 0.1 A.U. Rotational bursting of the dust particles by ion impacts was found to be unlikely and therefore not a source of brightness changes. Dissert. Abstr.

N76-19035 Iowa Univ., Iowa City.
ENTRY OF LOW-ENERGY SOLAR PROTONS INTO THE EARTH'S MAGNETOTAIL Ph.D. Thesis
Nicolaos Apostolos Saflekos 1975 90 p
Avail: Univ. Microfilms Order No. 76-2172

Sudden changes in solar proton intensities were observed by one satellite outside and by one or two satellites inside the earth's magnetotail. An effective magnetotail length (downstream distance to interconnection) was calculated. This length increased as the position of the interior satellite receded from the magnetopause, regardless of the direction of the interplanetary magnetic field. Generally, the downstream distances of direct entry into the magnetotail are between 25 and 900 earth radii. Sharp intensity discontinuities and even fine structures in low energy solar proton profiles were preserved and detected with a time delay in the magnetotail. No smoothing out of the structures was observed, indicating a lack of diffusive access of low energy protons to the geomagnetotail lines. Cross sectional radii of the magnetospheric tail at two different distances from the earth along the sun-earth line were determined. Field line convection velocities at low altitudes and high latitudes were also estimated. Dissert. Abstr.

N76-19036*# Scientific Translation Service, Santa Barbara, Calif.
ACTIVE REGIONS IN THE SOLAR WIND FROM DATA OF COMET OBSERVATIONS
V. P. Tarashchuk Washington NASA Feb. 1976 10 p refs Transl. into ENGLISH from Astrometriya i Astrofiz. (USSR), no. 22, 1974 p 53-57
(Contract NASw-2483)
(NASA-TT-F-16712) Avail: NTIS HC $3.50 CSCL 03B

Cases in which the aberrational velocities of the solar wind exceed the upper limit of solar wind velocity (1000 - 1500 km/sec) and when the angles between comet tail axis and the extended radius vector are negative were considered in the light of observational data. These phenomena were found to be related to the 27 day synodic rotation cycle of the sun and are often observed on the same day. A common physical agent is inferred. Author

N76-19037# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
A COMPARISON OF FLARES AND PROMINENCES IN D3 AND H(ALPHA) Final Report, 1 Jul. 1974 - 30 Jun. 1975

Harry E. Ramsey, Sara F. Martin, and Karen L. Harvey 30 Jun. 1975 33 p refs
(Contract F19628-75-C-0052; AF Proj. 7649)
(AD-A016758; AFCRL-TR-75-0355) Avail: NTIS CSCL 03/2

During 1973, flares were photographed using a 0.4A filter on the D3 line of HeI and, in 1974, with an additional passband at 0.8A into the red wing. During most of this period, time-lapse photographs also were taken on either or both the H(alpha) multi-slit spectrograph and the H(alpha) Doppler filter. On a separate telescope, limb events were photographed in D3 and H(alpha) through similar 8A filters. Very few flares displayed D3 in emission in part of the flare. For large flares, some absorption parts of the D3 flare correspond closely to the H(alpha) flare both spatially and temporally. However, the D3 flare boundaries are more sharply defined. It seemed D3 absorption events were correlated more frequently with surges and active filaments than with flare elements. The relative brightness of D3 and H(alpha) were examined for a number of solar phenomena observed at the limb. High velocity portions of surges, erupting filaments and loops brightened more in H(alpha) were examined for a number of solar phenomena observed at the limb. High velocity portions of surges, erupting filaments and loops brightened more in H(alpha) than in D3. In limb flares, D3 brightened more than H(alpha). GRA

N76-19038*# California Univ., Riverside. Dept. of Physics.
UPPER LIMITS TO THE QUIET-TIME SOLAR NEUTRON FLUX FROM 10 TO 100 MeV
Shin Moon, George M. Simnett, and R. Steven White 23 Jun. 1975 32 p refs
(Grant NGR-05-008-022; Contract N00014-69-A-0200-5004)
(NASA-CR-146331; AD-A015672; IGPP-UCR-75-15) Avail: NTIS CSCL 04/1

The UCR large area solid-angle double scatter neutron telescope was flown to search for solar neutrons on 3 balloon flights on September 26, 1971, May 14, 1972 and September 19, 1972. The first two flights were launched from Palestine, Texas and the third from Cape Girardeau, Missouri. The float altitude on each flight was at about 5 g/sq cm residual atmosphere. Neutrons from 10 to 100 MeV were measured. No solar flares occurred during the flights. Upper limits to the quiet time solar neutron fluxes at the 95% confidence level are .00028, .00046, .00096 and .00090 neutrons/sq cm-sec in the energy intervals of 10-30, 30-50, 50-100 and 10-100 MeV, respectively. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-19039*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
REDUCTION AND ANALYSIS OF ATS-6 DATA Final Report, 1 May - 15 Jul. 1975
G. A. Paulikas and J. B. Blake Sep. 1975 26 p refs
(Contract NASw-2762)
(NASA-CR-146347; ATR-75(7517)-1; SPL-76(7517)-1) Avail: NTIS HC $4.00 CSCL 03B

A data reduction program was developed and debugged which presents the Aerospace particle data and the UCLA magnetometer data in a variety of formats suitable for analysis as well as further data processing. Fifty days of data were processed through this program and analysis of these data were begun. In addition, modifications were made to an old ATS-1 program in order to enable this program to process ATS-1 data obtained simultaneously with ATS-6 data acquisitions during 1974. Some analysis of ATS-1 data and comparison with ATS-6 data also went forward. Preparations were begun to transfer ATS-6 data to the National Space Science Data Center. These efforts are described in detail. Author

N76-19040# Physical Research Lab., Ahmedabad (India).
A STUDY OF DAYS SHOWING NON-FIELD-ALIGNED DIFFUSION VECTORS OF COSMIC RAY DIURNAL ANISOTROPY
R. P. Kane [1975] 14 p refs Submitted for publication
(CR-75-01) Avail: NTIS HC $3.50

Days during 1965-68 when significant non-field-aligned diffusion of cosmic ray diurnal anisotropy occurred were studied in detail. It was shown that whereas a large hour-to-hour and/or day-to-day variability of the interplanetary ecliptic magnetic field direction may favor non-field-aligned diffusion, it is not a necessary condition. Some characteristics of the diurnal anisotropy seem to indicate the possibility of more than one mechanism (sources and/or sinks) operating simultaneously, distorting the usually assumed simple picture of a radially outward convection and field-aligned inward diffusion giving the observed vector along about 18 LT in space. Author

N76-19041# Physical Research Lab., Ahmedabad (India).
DAY-TO-DAY VARIABILITY OF IONOSPHERIC ELECTRON CONTENT AT MID-LATITUDES
R. P. Kane [1975] 13 p refs Submitted for publication
(AER-75-03) Avail: NTIS HC $3.50

The day-to-day variability of the daily range and hour of maximum total electron content (TEC) was studied using data obtained from the Faraday rotation of signals from geostationary satellites at various locations. Fluctuations sometimes as large as plus or minus 50% in magnitude of TEC and plus or minus 4 hours in the time of maximum were observed, even on quiet days. The TEC changes at locations separated by more than about 3000 km. in latitude or longitude show poor correlations. Results indicate that no relationship of the TEC exists with changes in solar radiation, the auroral electrojet, or changes in interplanetary magnetic field components. It is suggested that erratic neutral winds blow away from the polar regions towards the equator even during quiet times and create convection cells which may result in ionospheric irregularities of about 3000 km. These irregularities wander about the globe slowly and give the observed day-to-day variability of TEC. Author

N76-19042# Physical Research Lab., Ahmedabad (India).
MECHANISM OF THE DIURNAL ANISOTROPY OF COSMIC RADIATION
R. P. Kane [1975] 17 p refs Submitted for publication
(CR-74-01) Avail: NTIS HC $4.00

The observed diurnal vector of cosmic ray neutron intensity at Deep River for the period 1965-68 was resolved into a radially outward convection vector and a diffusion vector, omitting days of Forbush decreases. The diffusion vector deviated from the interplanetary field direction by more than 1 hour in 60% of the cases and more than 2 hours in 35% of the cases. Days of large deviations were studied in detail. On some days, the diffusion vector remained along the gardenhose direction even though the field deviated from it. On some days the reverse situation occurred. On some days when the net diffusion was not field-aligned, very large perpendicular and/or transverse diffusion implied cosmic ray gradients as high as 10%/A. U. or more in the ecliptic plane and/or perpendicular to it. Since there is no experimental evidence for such high gradients, it is suggested that the possibility of other processes as yet undiscovered which could augment the convection-diffusion mechanism should be kept in mind. Author

N76-19043*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INFRARED EMISSION FROM THE ATMOSPHERE ABOVE 200 km
Janet P. Simpson Washington Feb. 1976 28 p refs
(NASA-TN-D-8138; A-6285) Avail: NTIS HC $4.00 CSCL 03B

The infrared radiation over the range from 4 to 1000 microns from atoms and molecules in the earth's atmosphere, between 200 and 400 km, was calculated. Only zenith lines of sight were considered. The excitation of the atoms and molecules is due to collisions with other molecules and to absorption of radiation from the earth and sun. In some cases, the abundances of the molecules had to be estimated. The most important lines are the forbidden lines from atomic oxygen at 63.1 and

147 micron, and the vibration-rotation band of nitric oxide at 5.3 micron. These lines can have intensities as high as a few times 0.001 ergs/sq cm/sec/steradian at 200 km altitude. In addition, the vibration-rotation bands of NO(+) at 4.3 micron and CO at 4.7 micron and the pure rotation lines of NO and NO(+) could be detected by infrared telescopes in space. Author

N76-19044*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CYG X-1: A RETURN TO THE PRE-1971 INTENSITY LEVEL AND A 5.6-DAY MODULATION
S. S. Holt, L. J. Kaluzienski (Maryland Univ., College Park), E. A. Boldt, and P. J. Serlemitsos Feb. 1976 11 p refs Submitted for publication
(NASA-TM-X-71073; X-661-76-37) Avail: NTIS HC $3.50 CSCL 03B

Ariel-5 all sky monitor data on Cyg X-1 X-ray intensity increase during 1975 are analyzed. Data cover rise, maximum, and decay variability of the constellation. Special attention was given to the failure of the increase to decay over the specified period of 5.6 days. Author

N76-19045*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR MODULATION OF GALACTIC COSMIC RAYS 4: LATITUDE DEPENDENT MODULATION
L. A. Fisk Jan. 1976 26 p refs
(NASA-TM-X-71070; X-660-76-27) Avail: NTIS HC $4.00 CSCL 03B

A numerical method is outlined for solving the equation which describes the solar modulation of cosmic rays in models where interplanetary conditions can vary with heliocentric latitude. As an illustration of the use of this method, it is shown how variations in the modulation with latitude could produce the small radial gradients in the intensity that were observed from the Pioneers 10 and 11 spacecraft. Author

N76-19046# Naval Academy, Annapolis, Md.
THE ZENITH-ANGLE DISTRIBUTION OF STOPPING MUONS AT SEA LEVEL, AND THE RESPONSE OF A STOPPING MUON COSMIC-RAY DETECTOR Research Report
Gordon N. Roesler, Jr. 22 May 1975 102 p refs
(AD-A015959; USNA-TSPR-72) Avail: NTIS CSCL 04/1

The zenith-angle distribution of stopping muons at sea level, and the response of a stopping muon cosmic-ray detector were investigated in this research report. In order to determine the angular response of a wide-angle stopping muon telescope, smaller detectors were placed in coincidence with it which provided a correlation of count rate with zenith-angle of particle arrival. Using numerical integration techniques, computer solutions were employed to predict the zenith-angle-selective count rates for various descriptions of the incident flux. A least-squares analysis yielded a cosine power expressed mathematically. Employing this flux expression in predictive computer programs provided an accurate model of the wide angle telescope response from which the telescope half-angle was determined. Considerations of overburden effects and data corrections are discussed. GRA

N76-19047*# California Univ., Riverside. Dept. of Physics.
A COSMIC GAMMA-RAY BURST ON MAY 14, 1975
Dennis Herzo, Bruce Dayton, Allen D. Zych, and R. Stephen White 21 Aug. 1975 18 p refs
(Grant NGR-05-008-022; Contract N00014-69-A-0200-5004) (NASA-CR-146333; AD-A015673; IGPP-UCR-75-16) Avail: NTIS CSCL 04/1

A cosmic gamma-ray burst is reported that occurred at 29309.11 s UTC, May 14, 1975. The burst was detected at an atmospheric depth of 4 g/sq cm residual atmosphere with the University of California double scatter gamma-ray telescope launched on a balloon from Palestine, Texas at 1150 UTC, May 13, 1975. The burst was observed both in the single scatter mode by the top liquid scintillator tank in anti-coincidence with the surrounding plastic scintillator and in the double scatter mode from which energy and directional information are obtained. The burst is 24 standard deviations above the background for single scatter events. The total gamma-ray flux in the burst, incident on the atmosphere with photon energy greater than 0.5 MeV, is 0.59 + or - 0.15 photons/sq cm. The initial rise time to 90% of maximum is 0.015 + or - 0.005 s and the duration is 0.11 s. Time structure down to the 5 ms resolution of the telescope is seen. The mean flux over this time period is 5.0 + or - 1.3 photons/sq cm/s and the maximum flux is 8.5 + or - 2.1 photons/sq cm/s. GRA

99 GENERAL

N76-19048# Advisory Group for Aerospace Research and Development, Paris (France).
DIRECTOR'S ANNUAL REPORT TO THE NORTH ATLANTIC MILITARY COMMITTEE, 1974
Mar. 1975 80 p refs
Avail: NTIS HC $5.00

A summary of the scientific and technical achievements accomplished during 1974 by AGARD was presented. The following information was given: (1) meetings held, (2) publications produced and consultant services rendered, (3) detailed description of the various individual programs, (4) personnel listing, and (5) budget summary. Author

N76-19049# Southampton Univ. (England).
[RESEARCH ACTIVITIES OF THE INSTITUTE OF SOUND AND VIBRATION RESEARCH] Annual Report for the year ending Mar. 1975
Mar. 1975 42 p refs
Avail: NTIS HC $4.00

A summary of the activities pursued at the Institute of Sound and Vibration Research for the year ending in March 1975 was presented. This includes work in the following areas: acoustics and fluid dynamics, automotive engineering, operational acoustics and audiology, structural dynamics, data analysis, noise and vibration control, and electronics research and development. Information is also given on staffing, academic awards, seminars, short courses and symposia, and service on external committees. ESA